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A MANUAL

OF

MATERIA MEDICA

AND

PHARMACOLOGY

COMPRISING THE

ORGANIC AND INORGANIC DRUGS WHICH ARE OR HAVE BEEN RECOGNIZED BY THE UNITED STATES PHARMACOPŒIA AND NATIONAL FORMULARY

TOGETHER WITH

IMPORTANT ALLIED SPECIES AND USEFUL SYNTHETICS

ESPECIALLY DESIGNED FOR STUDENTS OF PHARMACY AND MEDICINE, AS WELL AS FOR DRUGGISTS, PHARMACISTS, AND PHYSICIANS

BY

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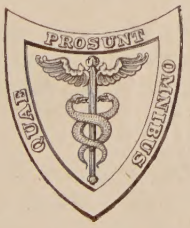
SEVENTH EDITION, THOROUGHLY REVISED

WITH FOUR HUNDRED AND NINETY-SEVEN ILLUSTRATIONS



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PRINTED IN U. S. A.

PREFACE TO THE SEVENTH EDITION.

THE present revision of this work has been made necessary in order that its contents be brought within current scientific thought and into accord with our two legal medical and pharmaceutical authorities: *United States Pharmacopœia*, 10th Edition, and *National Formulary*, 5th Edition, whose broad and sweeping changes, over their predecessors, demand conformity from any text-book of a commentary character. While to do this has imposed a certain liberty with these standards, care has been taken not to absorb or usurp their province or phraseology, in spite of a similar approach and treatment often serving to render comprehension and familiarity more easy.

Although the primary stress continues upon supplementing knowledge of the *Pharmacopœia*, yet that of the *Formulary* has scarcely been made secondary: for if extending the curriculum of our professional institutions to three and four years is to mean anything to the Materia Medica side—it is here where additional instruction is most needed. Consequently, all drugs and preparations recognized by these standards have been considered, the drugs being designated by either *U.S.P.* or *N.F.*, the preparations simply by numerals (1, 2, 3, etc.), except when occurring in mixed groups—those of the *Formulary* being differentiated by *N.F.*

Practical working formulæ of most preparations are given in brief, but sufficient to yield, in emergency, accurate and satisfactory results. The collateral synonyms—Br., Fr., Ger., of our Pharmacopœial drugs and preparations have been taken from the *British Pharmacopœia*, 1914, *French Codex*, 1908, *Deutsches Arzniebuch*, 1926, and cannot fail to be of service in both student and professional life.

The arrangement of the drugs remains practically the same as that followed in previous editions, being based upon the principle of *associating as nearly together as possible those substances, organic and inorganic, which have a common or allied origin, allowing those next related to follow in regular order, the basal or parental source thus being kept paramount.* Vegetable drugs, therefore, appear in the order of natural historic relationship of the plants from which obtained—*i. e.*, botanic

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4407

sequence, beginning with the more simple and gradually approaching those more complex. That this might be possible and in accord with Nature's process of evolution, the classification of Engler and Prantl, as enunciated in their *Die Natürlichen Pflanzenfamilien*, has been followed, modified, however, occasionally in accordance with Engler's *Syllabus der Pflanzenfamilien*, and also Britton and Brown's *Illustrated Flora*. Owing to deletions and demotions of so many hitherto Pharmacopœial vegetable drugs (the aggregate furnishing the basis of our plant classification) the author felt compelled to review meticulously this system, in many volumes, so as, if possible, to follow it in this edition more closely and to minimize the disturbance of the exact sequence heretofore in use. While there have been transpositions and occasional reversals in position of some drugs, the result has been a veritable improvement. Animal drugs also are treated so as to be in harmony with this great natural law of development of the animals from which obtained—zoölogic sequence, beginning with the lower and proceeding always to those of higher organization. Inorganic drugs, carbon and synthetic compounds are arranged similarly, their chemical relationship, however, being borne always in mind. Measurements are expressed in the metric system, followed by approximate equivalents in the English, and temperature is stated in both Centigrade and Fahrenheit scales, thereby giving an equal opportunity for use according to individual preference. Doses are stated in the apothecaries' and metric system, in the hope that the easy comparison of parallel quantities may produce a stronger mental impression, and thereby become an influence toward metric education.

The accent of generic and specific names continues to be placed on the final letter, consonant or vowel, of the accented syllable (not simply upon the vowel of that syllable)—certainly the most rational method, and one by which it is believed the student will obtain more readily an intelligent idea of pronunciation. Several pages will be found devoted to the pronunciation of words more or less troublesome to the average student, the aim having been to accept the best philologists rather than general usage.

The treatise on the microscope has been retained, not so much in the belief that it represents a sufficiently exhaustive exposition of the subject, as in the hope that the primitive essentials there outlined may suggest to pharmacists and physicians, at least, its vast importance and the ultimate need in it of even more advanced and technical knowledge. The Recapitulation Tables, always popular, continue to

include the most salient points of the U.S.P. vegetable and animal drugs, and must be valuable wherever a condensed summary is desired.

A few new illustrations, elucidating characteristics of plants recently made official, have been added in the hope of aiding visual instruction. In the compilation many subjects have been entirely rewritten, while all have received necessary changes in conformity with scientific progress, the constant effort having been—to seek and appropriate the latest and best sources of knowledge pertinent to the domain, and to guard against errors in figures and statement, such as might be expected but believed, at most, few and readily amenable to correction through personal intelligence.

From the mechanical side the work has gone through a complete resetting and recasting, evidently affording a more attractive dress, in that several styles of type are quite distinctive from those of former editions. The author has been materially assisted in the labor by Dr. Albert F. Judd, professor of Botany and Materia Medica in the University of Pittsburgh, where for many years he has been and still is, actively engaged in teaching, a fact which in itself assures no neglect of the actual present student demands. He further wishes to express gratitude to those who have used the work in their teaching, and to those who have contributed encouraging suggestions. Especially is he indebted to the publishers for aid in preparing the index and for willing endeavor to perform their portion of the labor, regardless of cost, in accordance with highest art.

DAVID M. R. CULBRETH, M.D.

BALTIMORE, 1927.

CONTENTS.

	PAGE
Definition of Materia Medica and its subdivisions	17–18
Forms in which medicines can be used	19–25
The avenues by and through which medicines enter the system	25 28
The means by which medicines are transmitted through the system	28
Conditions which may modify the action, hence the dose of drugs	28 33
The classifications of medicines:	
1. Alphabetic Sequence	34
2. Chemical Constituents	34–35
3. Morphologic and Anatomic	35 37
4. Therapeutic Effect	37 47
5. Natural Affinities (Botanical)	47 54

PART I.

ORGANIC DRUGS FROM THE VEGETABLE KINGDOM	55–629
THALLOPHYT(ES)-A—Algæ, Fungi	55–67
Gelidiaceæ, Red Seaweed Family—Agar	55–59
Hypocreaceæ, Flesh-consuming Family—Ergota	60–67
PTERIDOPHYT(ES)-A—Filicinæ, Lycopodinæ	67–72
Polypodiaceæ, Fern Family—Aspidium	67–70
Lycopodiaceæ, Club-moss Family—Lycopodium	70–72
SPERMATOPHYT(ES)-A—Gymnospermæ, Angiospermæ	72–629
Pinaceæ (Coniferæ), Pine Family, Conifers—Terebinthina, Pinus Pumilio, Juniperus, Juniperus Oxycedrus	72–87
ANGIOSPERMÆ	87–626
Monocotyledones	87–144
Graminaceæ, Grass Family—Amylum, Sucrosum, Maltum	82–93
Melanthaceæ, Bunch-flower Family—Veratrum Viride	102–107
Liliaceæ, Lily Family—Colchicum, Aloe, Scilla	107–121
Smilaceæ, Smilax Family—Sarsaparilla	121–129
Zingiberaceæ, Ginger Family—Zingiber, Cardamomi Semen	129–139
Orchidaceæ, Orchid Family—Vanilla	139–144
Dicotyledones	144–675
CHORIPETALÆ	144–459
Piperaceæ, Pepper Family—Cubeba	144–151
Salicaceæ, Willow Family—Salix	152–155
Fagaceæ (Cupuliferæ), Beech Family—Galla	155–163
Ulmaceæ, Elm Family—Ulmus	163–165
Moraceæ, Mulberry Family—Cannabis	165–172
Santalaceæ, Sandalwood Family—Oleum Santali	172–174
Aristolochiaceæ, Birthwort Family—Serpentaria	174–177

PAGE

POLYGONACEÆ, Buckwheat Family—Rheum 177–185
CHENOPODIACEÆ, Goosefoot Family—Oleum Chenopodii 185–190
MYRISTICACEÆ, Nutmeg Family—Myristica 190–194
RANUNCULACEÆ, Crowfoot Family—Hydrastis, Cimicifuga, Aconitum 194–210
BERBERIDACEÆ, Barberry Family—Podophyllum 210–215
MENISPERMACEÆ, Moonseed Family—Calumba 215–222
LAURACEÆ, Laurel Family—Cinnamomum, Camphora, Sassafras . . 222–236
PAPAVERACEÆ, Poppy Family—Opium 236–251
CRUCIFERÆ, Mustard Family—Sinapis Nigra 251–257
HAMAMELIDACEÆ, Witch Hazel Family—Styrax 257–263
ROSACEÆ, Rose Family—Rosa 264–271
DRUPACEÆ, Plum Family—Prunus Virginiana, Amygdala Amara, Amygdala Dulcis 272–281
MIMOSACEÆ, Mimosa Family—Acacia 281–287
CÆSALPINIACEÆ, Senna Family—Copaiba, Senna 287–299
KRAMERIACEÆ, Krameria Family—Krameria 299–303
PAPILIONACEÆ (LEGUMINOSÆ), Pea Family—Tolu, Balsamum Peruvianum, Tragacantha, Glycyrrhiza, Santalum Rubrum, Kino, Araroba, Physostigma 303–330
LINACEÆ, Flax Family—Linum 330–334
ERYTHROXYLACEÆ, Coca Family—Coca 334–340
RUTACEÆ, Rue Family—Buchu, Pilocarpus, Aurantii Amari Cortex, Aurantii Dulcis Cortex, Limonis Cortex 341–362
SIMARUBACEÆ, Quassia Family—Quassia 362–365
BURSERACEÆ (AMYRIDACEÆ), Myrrh (Frankincense) Family—Myrrha 365–369
POLYGALACEÆ, Milkwort Family—Senega 369–372
EUPHORBIACEÆ, Spurge Family—Oleum Tiglii, Oleum Ricini . . . 372–384
ANACARDIACEÆ, Sumac(h) Family—Rhus Glabra 384–391
RHAMNACEÆ, Buckthorn Family—Cascara Sagrada 391–397
MALVACEÆ, Mallow Family—Althæa, Gossypium 397–404
STERCULIACEÆ, Silk Cotton Family—Oleum Theobromatis 404–408
THEACEÆ (TERNSTRŒMIACEÆ), Tea Family—Caffeina 409–411
GUTTIFERÆ (CLUSIACEÆ), Gamboge (Mangosteen) Family—Cambogia 411–415
FLACOURTIACEÆ (BIXACEÆ), Arnotto Family—Oleum Chaulmoogræ . 415–420
LYTHRACEÆ (PUNICACEÆ), Loosestrife Family—Granatum 420–424
MYRTACEÆ, Myrtle Family—Caryophyllus, Oleum Cajuputi, Eucalyptus 424–437
UMBELLIFERÆ, Parsley (Carrot) Family—Coriandrum, Carum, Anisum, Fœniculum, Asafœtida 437–459
GAMOPETALÆ 460–629
ERICACEÆ, Heath Family—Gaultheria, Uva Ursi 460–467
STYRACEÆ, Storax Family—Benzoinum 467–472
OLEACEÆ, Olive Family—Manna, Oleum Olivæ 472–478
LOGANIACEÆ, Logania Family—Nux Vomica 478–487
GENTIANACEÆ, Gentian Family—Gentiana 487–491
APOCYNACEÆ, Dogbane Family—Strophanthus 491–499
CONVOLVULACEÆ, Morning-glory Family—Jalapa, Ipomœa 499–506
HYDROPHYLLACEÆ, Waterleaf Family—Eriodictyon 506–508
LABIATÆ, Labiate (Mint) Family—Oleum Rosmarini, Oleum Lavandulæ, Thymus, Mentha Viridis, Mentha Piperita 508–529
SOLANACEÆ, Nightshade (Potato) Family—Capsicum, Belladonnæ Folia, Belladonnæ Radix, Hyoscyamus, Stramonium 530–552

PAGE

Scrophulariaceæ, Figwort Family—Digitalis 552–561
Rubiaceæ, Madder Family—Cinchona, Gambir, Caffeina, Ipecacuanha 561–594
Valerianaceæ, Valerian Family—Valeriana 594–597
Cucurbitaceæ, Gourd Family—Ecballium, Colocynthis, Pepo . . . 597–605
Campanulaceæ, Bell-flower Family—Lobelia 605–608
Compositæ, Composite (Thistle) Family—Santoninum 608–629

PART II.

ORGANIC DRUGS FROM THE ANIMAL KINGDOM 631–675

Invertebrata 631–643
Insecta 631
Hemiptera, Hemipterous Order (Family)—Coccus 631–635
Coleoptera, Coleopterous Order (Family)—Cantharis 635–639
Hymenoptera, Hymenopterous Order (Family)—Apis Mellifera . . 639–643
Vertebrata 643–675
Pisces 643–648
Teleost(eæ)-ia, Teleostean Order (Family)—Oleum Morrhuæ . . . 643–648
Mammalia 648–675
Cetaceæ, Cetaceous Order (Family)—Cetaceum 634–635
Pachyderma(l)-tous Order (Family)—Adeps, Pancreatinum, Pepsinum 635–639
Ruminantia, Ruminant Order (Family)—Sevum Præparatum, Adeps Lanæ, Epinephrina, Thyroideum, Fel Bovis, Lactosum, Gelatinum, Antitoxinum Diphthericum, Antitoxinum Tetanicum, Vaccinum Variolæ, Pituitarium 655–675

PART III.

INORGANIC DRUGS FROM THE MINERAL KINGDOM 677–840

Hydrogen—Aqua, Liquor Hydrogenii Dioxidi 677–679
Oxygenium 680
Nitrogen—Aqua Ammoniæ, Aqua Ammoniæ Fortior, Nitrogenii Monoxidum, Acidum Nitricum 680–684
Carbon—Carbo Ligni, Carbo Animalis, Carbonei Tetrachloridum . . 684–686
Silicium—Terra Silicea Purificata, Talcum Purificatum, Pumex . . 686–688
Boron—Acidum Boricum 688–690
Sulphur—Sulphur Sublimatum, Acidum Sulphuricum 690–694
Phosphorus—Acidum Phosphoricum, Acidum Hypophosphorosum . 694–697
Chlorine—Liquor Chlori Compositus, Chloramina, Dichloramina, Acidum Hydrochloricum 698–701
Bromum—Acidum Bromauricum, Carbromalum 701–703
Iodum—Liquor, Tinctura, Unguentum 703–705

PAGE

POTASSIUM—Potassii Carbonas, P. Bicarbonas, P. Hydroxidum, P. Sulphurata, P. Acetas, P. Citras, Liquor P. Citratis, P. Bitartras, P. et Sodii Tartras, P. Chloras, P. Bromidum, P. Iodidum, P. Nitras, P. Permanganas, P. Hypophosphis, P. Sulphas, P. Chloridum, etc. . 705–723

SODIUM—Sodii Boras, S. Chloridum, S. Indigotindisulphonas, S. Carbonas Monohydratus, S. Bicarbonas, S. Hydroxidum, S. Acetas, S. Citras, S. Benzoas, S. Bromidum, S. Iodidum, S. Salicylas, S. Sulphas, S. Phosphas, S. Biphosphas, S. Cacodylas, S. Nitris, S. Thiosulphas, S. Arsenas, S. Glycerophosphas, S. Hypophosphis, S. Perboras 723–742

LITHIUM—Lithii Carbonas, L. Bromidum, L. Citras, L. Salicylas, L. Benzoas, etc. 743–745

AMMONIUM—Ammonii Benzoas, A. Bromidum, A. Chloridum, A. Carbonas, A. Salicylas, A. Hypophosphis, A. Phosphas, A. Valeras, etc. 745–751

MAGNESIUM—Magnesii Sulphas, M. Carbonas, M. Oxidum, M. Oxidum Ponderosum, Liquor M. Citratis, M. Chloridum, etc. 751–756

CALCIUM—Calx, C. Chlorinata, Calcii Chloridum, C. Carbonas Præcipitatus, C. Glycerophosphas, Creta Præparata, C. Bromidum, C. Iodobehenas, C. Lactas, C. Hypophosphis, C. Lactophosphas, C. Phosphas Præcipitatus 756–767

BARIUM—Barii Sulphas, B. Chloridum, B. Dioxidum, etc. 767–769

STRONTIUM—Strontii Salicylas, S. Bromidum, S. Iodidum, etc. . . . 769–771

ALUMINUM—Alumen, Alumini Chloride, A. Sulphas, Kaolinum, etc. . 771–774

CERIUM—Cerii Oxalas 774–775

FERRUM—Reductum, Liquor Ferri Chloridi, Syrupus F. Iodidi, Pilulæ F. Iodidi, F. Sulphas, Liquor F. Tersulphatis, F. Carbonas Saccharatus, Massa F. Carbonatis, Pilulæ F. Carbonatis, F. Hydroxidum cum Magnesii Oxido, F. et Ammonii Citras, F. Phosphas Solubilis, F. Albuminatum, F. Peptonatum, F. Glycerophosphas, F. Hypophosphis, F. Lactas, F. Pyrophosphas Solubilis, F. Oxidum Saccharatum, Liquor F. Subsulphatis, etc. 775–791

MANGANUM—Mangani Hypophosphis, M. Citras Solubilis, M. Glycerophosphas Solubilis, etc. 792–794

CHROMIUM—Chromii Trioxidum 794–795

URANIUM—Uranii Nitras 795–796

ZINCUM—Zinci Chloridum, Z. Sulphas, Z. Oxidum, Z. Acetas, Z. Stearas, Calamina Præparata, Z. Phenolsulphonas, etc. 796–803

CADMIUM 803

PLUMBUM—Plumbi Monoxidum, P. Acetas, P. Iodidum, P. Oxidum Rubrum, etc. 803–808

CUPRUM—Cupri Sulphas, etc. 808–810

BISMUTHUM—Bismuthi Subnitras, B. Subcarbonas, B. Subsalicylas, B. Subgallas, Magma Bismuthi, B. Betanaphtholas, B. et Ammonii Citras, etc. 810–815

ARGENTUM—Argenti Nitras, Argento-Proteinum Forte, A. Proteinum Mite, etc. 815–819

HYDRARGYRUM—Hydrargyri Iodidum Flavum, H. Chloridum Corrosivum, H. Chloridum Mite, H. Oxidum Rubrum, etc. 819–831

ARSENUM—Arseni Trioxidum, Arsphenamina, etc. 831–835

ANTIMONIUM—Antimonii et Potassii Tartras, A. Oxidum, etc. . . . 835–838

STANNUM, AURUM—Auri et Sodii Chloridum, Acidum Bromauricum . 838–839

PLATINUM 840

PART IV.

PAGE

ORGANIC CARBON COMPOUNDS 841–911

Hydrocarbons—Benzinum, Purificatum, Petrolatum Liquidum, Petrolatum, Petrolatum Album, Paraffinum, P. Chlorinatum, Bitumen Sulphonatum, etc. 842–848

Alcohols—Alcohol, Spiritus Frumenti, Spiritus Vini Vitis, Glycerinum, Spiritus Glycerilis Nitratis, etc. 848–854

Aldehydes—Liquor Formaldehydi, Paraformaldehydum, Methenamina, Paraldehydum, Chloralis Hydras, Methylthioninæ Chloridum, Chloroformum, Bromoformum, Iodoformum, Ethylis Chloridum, Acetonum, Sulphonmethanum, Sulphonethylmethanum, etc. . . 854–868

Acids—Aceticum, Aceticum Glaciale, Trichloraceticum, Acetyltannicum, Oleicum, Stearicum, Tartaricum, Citricum, Lacticum, Oxalicum 868–877

Ethers—Æther, Æther Aceticus, Spiritus Æthylis Nitrosi, Amylis Nitris, Procainæ Hydrochloridum, Æthylis Aminobenzoas, Barbitalum, Phenobarbitalum, etc. 877–885

Phenols—Benzenum, Phenol (Acidum Carbolicum), Creosotum, Cresol, Guaiacol, Thymolis Iodidum, Resorcinol, Acidum Salicylicum, Acidum Phenylis Salicylas, Phenolphthaleinum, Phenolsulphonphthaleinum, Trinitrophenol, etc. 886–901

Naphthols—Betanaphthol, Naphthalenum, etc. 901–903

Anilids, Anilines—Acetanilidum, Acetphenetidinum, Glusidum, Acetylsalicylicum, Cinchophenum, Antipyrina, Amidopyrina, Eucainæ Hydrochloridum, etc. 903–911

PART V.

NON-PHARMACOPŒIAL ORGANIC CARBON COMPOUNDS 913–952

Halogen Derivatives—Pental, Methyl Chloride, Methylene Bi(di)-chloride, Methylthionine Chloride, Methenyl Trichloride, Methenyl Tribromide, Methenyl Tri-iodide, Ethyl Chloride, Ethylene Bi(di)-chloride, Ethylidene Chloride, Ethyl Bromide, Ethylene Bromide 916–919

Oxygen Derivatives—Methyl Alcohol, Denatured Alcohol, Amylene Hydrate, Tannoform, Butyl Chloral Hydrate, Chloralformamide, Chloralose, Acetozone 919–922

Sulphur Derivatives—Tetronal, Methylal 923–924

Urea Derivatives—Ethyl Carbamate, Euphorin, Ural, Somnal, Sucrol, Thiosinamin 924–925

Thiophene Derivatives—Thiophene Di-iodide, Sodium Thiophene-sulphonate 926

Terpenes—Terebene, Terpin Hydrate 926

Phenol Derivatives—Bromol, Aseptol, Sozoiodol, Sulphaminol, Cresol, Benzo-para-cresol, Creolin, Lysol, Losophan, Europhen, Bismuth Oxyiodogallate (Airol), Bismuth Tribromophenol (Xeroform), Antiseptin 926–930

PAGE

Di-hydroxyl Phenol Derivatives—Guaiacol—Benzoate, Cinnamate, Salicylate, Eugenol Acetamide, Thioresorcin, Hydroquinone, etc. . 930–932

Benzene (Amido) Derivatives—Formanilide, Antisepsin, Iodoacetanilid, Methylacetanilid (Exalgine), Methacetin, Thermodin, Chinaphenine, Holocaine, Lactophenin, Sedatin, Benzanilid, Phenocoll Hydrochloride, Gallanilide, Phenocoll Salicylate, Hydracetin, Hypnone, Gallacetophenone, Agathin 932–939

Carboxyl Derivatives (CO^2H)—Benzoic Acid, Gluside, Gluside Soluble 939

Oxybenzoic (Salicylic) Derivatives—Di-iodo-salicylic Acid, Sodium Dithio-salicylate, Novaspirin, Meta-cresalol, Betol, Salacetol, Salophen, etc. 939–941

Para-oxybenzoic Derivatives—Anisic Acid, Orthoform, Orthoform-new, Anesthesin 942–943

Naphthalene Derivatives—Benzonaphthol, di-iodo-beta-naphthol, Naphthol-bismuth, Asaprol, Anthrarobin 943–945

Organic Bases—Piperazine, Lycetol, Diaphtherin, Analgen, Orexine Hydrochloride, Thalline, Thalline Sulphate, Thalline Tartrate, Antipyrine Salicylate (Salipyrine), Amidopyrine (Pyramidon), Hypnal, Iodopyrine, Eucaine, Theobromine, Diacetylmorphine (Heroine) Hydrochloride, Tropacocaine Hydrochloride, Stovaine, Opsonins, Roentgen Rays 945–952

PART VI.

THE MICROSCOPE AND ITS USE IN MATERIA MEDICA 953–971

Description of the Microscope 953–938
Requisites of a Good Microscope 958–960
Directions for Using the Microscope 960–961
Accessory Apparatus and Reagents 961–964
Some Advanced Microscopic Methods and Appliances 965–967
The Microscope in the Drug-store 967–971

APPENDIX.

Poisons—Treatment and Antidotes 973–984
Prescription Writing of the Physician 984–987
Table of Weights, Measures, Doses, Drops, Thermometers, Abbreviations, Constituents, Pronunciations 987–993

Index 1003

ABBREVIATIONS USED THROUGHOUT THIS WORK.

The degree sign (°) associated with numerals indicates *feet*, except when followed by the capital letters C. and F., then it represents *degrees* (temperature): the prime sign (′) attached to figures is used for *inches*, but when following vowels or consonants denotes the *accented syllable*.

āā., of each.
Abs., abs., Absence.
Adj., adj., Adjective.
Alc., alc., Alcohol.
Ar., Arabic.
Br., British.
Br. P., British Pharmacopœia.
Cod., Codex, French Pharmacopœia.
Contr., contr., Contraction.
Cult., cult., Cultivated.
Dif., dif., Difference.
Dil., dil., Dilute(d).
Dist., dist., Distilled, Distinction.
Eng., English.
Fr., French.
Fr., fr., From.
Ger., German.
Ger. P, Ger. Phar., German Pharmacopœia.
Gr., Greek.
Heb., Hebrew.
Hind., Hindoo.
Ind., ind., Indicating.
Lim., lim., Limit.
Lit., lit., Literally.
Mt., Mount., Mountain.
Nat., nat., Naturalized.
N. F., National Formulary.
N. O., Natural Order.
OE., Old English.
P. c., p. c., Per cent(um).
P. G., German Pharmacopœia.
P. I., International Protocol.
Peruv., Peruvian.
Per., Pers., Persian.
Portg., Pg., Portuguese.
Prep(s)., Preparation(s).
Pres., pres., Presence of.
P.p., pp., Past participle.
Skr., Skt., Sanskrit.
Sp., Spanish.
Syn., Synonym.
Unoff., Unofficial.
U. S. P., United States Pharmacopœia.
C., Centigrade.
cc., Cubic centimetre.
Cm., Centimetre.
F., Fahrenheit.
Gm., Gramme.
Gr., gr., Grain.
Kg., Kilogramme.
Kl., Kilolitre.
Km., Kilometre.
Q. S., q. s., Sufficient quantity.
Sp. gr., sp. gr., Specific gravity.
T. S., Test Solution.
V. S., Volumetric Solution.
L., Litre.
℔., Pound.
M., Metre.
Ml., Millilitre.
Mm., Millimetre.
♏., min., Minim.
ss., Half.
$\frac{N}{10}$., Decinormal.
ʒ, Dram., Drachm (solid, fluid).
℥, Ounce, (solid, fluid).
℈, Scruple.
O, Pint.
+, plus.
−, minus.
×, multiplication.
=, equals.
□, square.

THE GREEK ALPHABET.

Α	α	a	. . . . .	Alpha.	Ν	ν	n	. . . . .	Nu.
Β	β	b	. . . . .	Bēta.	Ξ	ξ	x	. . . . .	Xi.
Γ	γ	g	. . . . .	Gamma.	Ο	ο	o short	. . .	Omīcron.
Δ	δ	d	. . . . .	Delta.	Π	π	p	. . . . .	Pi.
Ε	ε	e short	. . .	Epsīlon.	Ρ	ρ	r	. . . . .	Rho.
Ζ	ζ	z	. . . . .	Zēta	Σ	σ ς	s	. . . . .	Sigma.
Η	η	e long	. . .	Eta.	Τ	τ	t	. . . . .	Tau.
Θ	θ ϑ	th	. . . . .	Thēta.	Υ	υ	u	. . . . .	Upsīlon.
Ι	ι	i	. . . . .	Iota.	Φ	φ	ph	. . . . .	Phi.
Κ	κ	k	. . . . .	Kappa.	Χ	χ	ch	. . . . .	Chi.
Λ	λ	l	. . . . .	Lambda.	Ψ	ψ	ps	. . . . .	Psi.
Μ	μ	m	. . . . .	Mu.	Ω	ω	o long	. . .	Oměga.

MATERIA MEDICA AND PHARMACOLOGY.

DISEASE seems to have been man's natural inheritance, while curative methods and remedies are largely his adaptation and creation. From early biblical times the ills "that flesh is heir to" were recognized as a deadly menace to the human family, and whether the vain appeal was made, then or since, to either (for each in turn enjoyed a period of favor) fetichism, sorcery, religious incantations, faith, Christian science, astrology, magic-art, enchantment, witchcraft, spells, charms, hydropathy, venesection, or drugs, the same inherent hope and purpose ever has prevailed—to relieve and palliate physical suffering. Human thought, happily, is no longer so speculative and superstitious, consequently universal intelligence has allowed medical appliances and treatment to be shaped into a systematic and veritable science.

MATERIA MEDICA (L. medical material) is a treatise upon the materials, agents, or appliances used in medicine—including their name, source (origin), habitat, family (natural order—organic), physical characteristics, methods by which obtained, tests for purity and adulterations, constituents (composition), forms of administration (preparations), physiological action (properties), uses (therapeutics—therapy), normal and lethal doses, antagonists, incompatibilities, synergists (organic and inorganic), and other important features.

PHARMACOLOGY (Gr. *φάρμακον*, a drug, medicine, + *λόγος*, discourse) is a similar but more modern term, implying the sum of scientific knowledge of drugs, which is taken to include their art of preparation—pharmacy, and all that is known of their action—pharmacodynamics, at present usually being restricted to this latter meaning. The subject in its entirety is so broad and comprehensive as to justify subdivisions—some receiving distinctive names.

1. *Pharmacy* (Gr. *φαρμακεία*, the use of drugs): comprising the art of preparing drugs in suitable forms for dispensing, administering, or applying, and includes an acquaintance with much of materia medica, practical and theoretical chemistry, and many manipulations peculiar to itself.

2. *Pharmacognosy* (Gr. *φάρμακον*, a drug, + *γνῶσις*, knowledge): comprising the study of physical and chemical characters of drugs—the knowledge of selecting, recognizing, and identifying true and false specimens by such characteristics.

3. *Pharmacodynamics* (Gr. *φάρμακον*, a drug, + *δύναμις*, power): comprising the knowledge of physiological action—power or strength

of remedial agents on living organisms of man or lower animals during health.

4. *Toxicology* (Gr. τοξικόν, poison, + λόγος, discourse): comprising the effect, nature, and detection of drugs when given in poisonous doses—the treatment and antidotes for same.

5. *Therapeutics* (Gr. θεραπεύειν, to cure): comprising the intelligent application or use of agents to cure disease—how they act on living organisms during sickness: (*a*) *rational*, when based upon known laws of the remedies and diseases, as gained through pathology, physiology, and pharmacodynamics, thereby giving the only scientific treatment; (*b*) *empirical*, when based solely upon clinical observation and experience—the employment of a remedy in any pronounced disease, from its valuable service in previous similar cases; (*c*) *general*, where other than drugs or medicines are used for curative purposes: (1) Hygienic agents—cleanliness, pure air, ventilation, proper food and clothing, rest, etc.; (2) mechanical agents (semi-surgical)—bleeding, leeches, cups, scarifications, issues, setons, frictions, massage, osteopathy, chiropractice, aspiration, acupuncture, gastric lavage, stomach-pump, sprays, syringes, catheters, bed-pans, urinals, hot-water bags, trusses, pessaries, suspensories, bandages, rubber stockings, jackets, thermometers, etc.; (3) physical agents—*Heat:* solar, artificial (dry or moist vapor), baths—tepid, 29–35° C. (85–95° F.), warm, 35–38° C. (95–100° F.), hot, 38–41° C. (100–106° F.), Turkish, 35–71° C. (95–160° F.), hip or sitz, hot wet-pack; *Cold:* plunge or shower bath, 4–15° C. (40–60° F.), cold wet-pack, rubbing wet-pack, 4–21° C. (40–70° F.), sponging, ice-bag, compresses, douches; *Light:* although at times contraindicated, acts usually as a stimulant or tonic to the blood—correcting imperfect nutrition and imparting strength to organs; *Darkness:* on the other hand, acts as a sedative or tranquillizing agent; *Air:* pure, impure, compressed, hot, 93–149–204° C. (200-300–400° F.); *Electricity:* continuous (galvanic) and induced (faradic) currents, static (frictional) by electric bath, spark, Leyden-jar shock, brush.

Upon the general subject of materia medica, and each of these subdivisions, there are very many published works, but only pharmacy has what may be termed a standard code for reference.

The *Pharmacopœia*, U. S. P. (Gr. φάρμακον, a drug, + ποιεῖν, to make), is such a standard for us, and other countries each have, in a measure, their own. It is issued by The Board of Trustees of the United States Pharmacopœial Convention, and describes the most important and reliable vegetable, animal and mineral drugs along with their preparations, doses and specific tests for identity and purity—the list being changed, more or less, in conformity with scientific progress, at each decennial edition. It has been adopted by Congress as a standard in the enforcement of the Pure Food and Drugs Act (1906), which controls the sale of drugs and chemicals throughout our country.

The *National Formulary*, N. F. is issued by the American Pharmaceutical Association, and treats of many drugs and preparations

scarcely secondary to those of the Pharmacopœia (in which formerly some were accepted), and although slightly less authoritative, it has received also official recognition by Congress as a standard in the enforcement of the Pure Food and Drugs Act.

The *Dispensatories*, several in number, are reference-works—in fact, materia medicas of the most liberal form, treating not only of the five departments as previously defined, but exhaustively of all other phases of the various sciences bearing upon each drug, official, semi-official, or non-official. Owing to their scope and reliability, they are regarded by the medical and pharmaceutic professions with scarcely less favor and authority than the Pharmacopœia and National Formulary.

Forms in which Medicines may be Used.

In early times the crude drugs usually were administered, but some being insoluble, nauseous, irritating, bulky, and ill-suited for either internal or external application, led to the adoption of other forms, such as decoctions, infusions, juices, powders, pills, ointments, etc. At the present day elegant pharmacy has placed us in possession of additional and still more acceptable forms and shapes, the most important here being enumerated.

I. Official, *U.S.P.* (liquids, semi-solids, solids).

1. *Acetum, Aceta* (vinegars).—10 p. c. Macerate drug, 10 Gm., 7 days with diluted acetic acid q.s. 100 cc., agitating frequently, filter: Scillæ.

2. *Aqua, Aquæ Aromaticæ* (aromatic waters).—Distilled water impregnated, often saturated, with a volatile substance, by (*a*) *distillation*—distilling mixture of drug, or volatile oil, with water, obtaining clear solution saturated with aromatic principle of plant, free from empyreumatic odors: Aurantii Florum, Rosæ Fortior; (*b*) *solution*—shaking occasionally during 12 hours, in capacious bottle, volatile oil .2 cc. with distilled water q.s. 100 cc., filtering; or may incorporate volatile substance with purified talc 1.5 Gm., or sufficient purified siliceous earth, or pulped filter paper, then add water to bottle, agitate: Anisi, Menthæ Viridis; (*c*) *aëration*—passing gas into water: Ammoniæ, Ammoniæ Fortior.

3. *Ceratum, Cerata* (cerates, L. *cera*, wax).—Unctuous-like ointments made firmer by the addition of wax; soften but do not melt at body-temperature; liquefy only above 40° C. (104° F.): Cantharidis, Resinæ.

4. *Collodium, Collodia* (collodions).—Collodion impregnated with medicinal substances for protection and medical effect: Flexile.

5. *Decoctum, Decocta* (decoctions, L. *decoquere*, to boil down).—5. p. c. aqueous solutions of vegetable drugs made by boiling the substance (5 Gm.) 15 minutes in a closely-covered vessel, allowing to cool therein, expressing, straining expressed liquid, adding through strainer

water q. s. 100 cc.; the strength of decoctions of energetic or powerful drugs should be specially directed by the physician.

6. *Elixir, Elixira* (elixirs, Ar. *el-ik'sir*, the philosopher's stone).—Sweet, aromatic, hydro-alcoholic, medicated liquids; alcoholic strength 20–25 p. c.: Aromaticum, Glycyrrhizæ.

7. *Emplastrum, Emplastra* (plasters, Gr. εμπλάσσειν, to daub on).—Substances fused in such proportions as to adhere at body-temperature; some are spread, others are not: Adhæsivum, Sinapis.

8. *Emulsum, Emulsa* (emulsions, L. *emulgere*, to milk out).—Aqueous, milky-like mixtures of oils, fats, or resins in a minutely subdivided state, suspended by mucilaginous materials; coagulated by acids, metallic salts, or spirituous liquids in large quantities: Asafœtidæ, Olei Terebinthinæ.

9. *Extractum, Extracta* (extracts, L. *ex*, out, + *trahere*, to draw).—Solid, semi-solid or powdered, made by evaporating medicinal solutions, or expressed juices of organic drugs, until representing 4–5 times the strength of the crude substances; these may be aqueous, alcoholic, hydro-alcoholic, acetous: Belladonnæ, Stramonii.

10. *Fluidextractum, Fluidextracta* (fluidextracts).—Solutions of organic drugs evaporated until 1 cc. represents the activity of 1 Gm. of crude drug: Belladonnæ Foliorum, Zingiberis.

11. *Glyceritum, Glycerita* (glycerites, Gr. γλυκύς, sweet).—Solutions of a drug in glycerin for external use: Acidi Tannici, Phenolis.

12. *Infusum, Infusa* (infusions, L. *infundere*, a watering).—5 p. c. aqueous solutions of vegetable drugs made by adding to the substance (5 Gm.), in a closely-covered vessel, boiling water (100 cc.), allowing to stand half an hour, straining with pressure, passing through strainer water q. s. 100 cc.; if activity of infusion (drug) is affected by heat, cold water only should be used; the strength of infusions of energetic or powerful drugs should be specially directed by the physician: Digitalis.

13. *Linimentum, Linimenta* (liniments, L. *linere*, to smear).—Medicinal liquids, containing usually a fixed or volatile oil, for external use by rubbing or by simple application: Calcis, Saponis Mollis.

14. *Liquors, Liquores* (liquors, L. *liquor, liquere*, fluid, liquid).—Mostly aqueous solutions of non-volatile chemical substances: Acidi Arsenosi, Zinci Chloridi.

15. *Magma, Magmæ* (L. fr. Gr. μάγμα, μάσσειν, to squeeze, knead).—A thin paste or mixture– a precipitate (hydroxide, etc.) tenaciously retaining liquid (water, alcohol) often removed only by forcible expression; usually white unless fluid contains iron, organic matter, etc.: Magnesiæ.

16. *Massa, Massæ* (masses, Gr. μάσσειν, to knead).—Pill-masses preserved in bulk to be used from when required: Ferri Carbonatis, Hydrargyri.

17. *Mel, Mella, Mellita* (honeys, Gr. μέλι, honey).—Medicines mixed with honey instead of syrup: Rosæ.

18. *Mistura, Misturæ* (mixtures, L. *miscere*, to mix).—Liquids of insoluble medicines suspended in water by some viscid substance, or solutions of one or more active liquids: Cretæ, Glycyrrhizæ Composita.

19. *Mucilago, Mucilagines* (mucilages, L. *mucere*, to be moldy, slimy).—Saturated aqueous adhesive liquids of gum or starch: Acaciæ, Tragacanthæ.

20. *Oleatum, Oleata* (oleates, L. *olea*, Gr. ἐλαία, olive tree, oil).—Solutions of medicines (alkaloids or metallic salts) in oleic acid: Hydrargyri.

21. *Oleoresina, Oleoresinæ* (oleoresins, L. *oleum*, oil, + *resina*, resin).—Natural solutions of resin in volatile oils, extracted by ether, acetone, or alcohol: Aspidii, Capsici.

22. *Oleum, Olea* (oils, L. *oleum*, Gr. ἔλαιον, oil).—Liquid active constituents, obtained by (*a*) *distillation:* Anisi, Terebinthinæ; (*b*) *expression:* Aurantii, Tiglii.

23. *Pilula, Pilulæ* (pills, L. *pilula*, a little ball, dim. of *pila*, a ball. Eng. abbr., *pil.*, pl. *pill*).—Globular or ovoid masses of medicinal material, 1–7.5 grs., held together by an adhesive substance: Aloes, Phosphori; these may be plain or coated with gelatin, sucrose, cocoa, tolu, silver-foil (to preserve and mask odor and taste), or salol, *Enteric Pills*, Gr. ἔντερον, intestine (to allow passage through the stomach intact, thereby not becoming dissolved until the duodenum or intestinal tract is reached. *Concentric Pills* are made of concentric layers of different ingredients to become dissolved and active at various points of the intestinal tract.

24. *Pulvis, Pulveres* (powders, L. *pulverare*, to powder).—Finely powdered drug or drugs, with or without a diluent, as lactose: Cretæ Compositus, Rhei Compositus.

25. *Resina, Resinæ* (resins, L.; Gr. ρητίνη, resin (of the pine)).—Resinous powders obtained by exhausting the vegetable drug with alcohol, and precipitating the tincture by adding water; they contain all the principles soluble in alcohol and insoluble in water: Ipomœæ, Podophylli.

26. *Spiritus, Spiritus* (spirit, spirits, L. *spirare*, to breathe, exhale).—Alcoholic or hydro-alcoholic solutions of volatile medicinal substances (chiefly volatile oils): Æthylis Nitritis, Vini Vitis. Also called, when 10 p. c. (England, 10–20 p. c.), *Essences* (*Essentiæ*).

27. *Suppositorium, Suppositoria* (suppositories, L. *supponere*, to place underneath).—Solids of suitable form, cone-shaped, pencil-shaped, globular, oviform, weighing 10–60 gr. (.6–4 Gm.), containing medicines, which melt when inserted into the rectum, nares, urethra, or vagina, the vehicles being oil of theobroma, glycerinated gelatin, sodium stearate: Glycerini.

28. *Syrupus, Syrupi* (syrups, Ar. *shurab*, a drink, beverage).—Concentrated solutions of sucrose, the menstruum being an aqueous solution of either medicinal or flavoring agents (simple syrup menstruum—distilled water): Acidi Citrici, Zingiberis. *Cordial* (*Cordiale*)—a one-fourth weaker medicated syrup.

29. *Tinctura, Tincturæ* (tinctures, L. *tingere*, to dye).—Alcoholic or hydro-alcoholic solutions of non-volatile (except iodine) drug-constituents: Aconiti, Zingiberis. *Tincturæ Medicamentorum (Herbarum) Recentium, Tinctures of Fresh Drugs*, N. F., 50 p. c.; macerate fresh drug, cut, bruised or crushed, 50 Gm., for 14 days, in a stoppered container with alcohol 75 cc., agitating frequently, drain on filter, through which add alcohol q. s. 100 cc. *Tincturæ Ætherœ, Ethereal Tinctures*, N. F., 10 p. c. (drug), + ether 1 volume, alcohol 2.

30. *Trituratio, Triturationes* (triturations, L. *triturare*, triturated).—Fine powders of medicinal substances 10 Gm., triturated intimately with lactose 90 Gm., added gradually and mixed thoroughly.

31. *Trochiscus, Trochisci* (troches, Gr. τροχίσκος, a pill, troche).—Solid, round, oval, or flat masses of one or more medicinal agents, with sucrose or extract of glycyrrhiza, or both, caused to adhere by tragacanth mucilage, often flavored: Acidi Tannici, Ammonii Chloridi. Also called *Lozenges, Tablets* (*Tabellæ*), in England of definite weight and chocolate base. *Toxitabellæ* (Hydrargyri Chloridi Corrosivi)—poison, only for external use. *Pastilles* (*Pastilli-us*), in England with glyco-gelatin base.

32. *Unguentum, Unguenta* (ointments, L. *unguere*, to smear, anoint).—Soft or solid fatty preparations, for external use, liquefying when rubbed upon the skin, and containing medicine in a basis of benzoinated lard, petrolatum, wool fat, prepared suet, expressed oil of almond, wax, spermaceti, paraffin, etc.: Acidi Borici, Zinci Oxidi. *Salve, Paste*—names often applied by laity to healing ointments.

II. Semi-official, *N.F.*

1. *Ampulla, Ampullæ* (ampuls, L. *ampulla*, a small narrow-necked vase, flask).—Hermetically sealed glass vessels (tubes with attenuated end or ends) of varying size, containing a sterilized medicinal liquid for hypodermic, intravenous, or inhalation purposes; when for inhalation—contents released by breaking off narrow end, or crushing in handkerchief; pearls, tears, or sealed bulbs (amyl nitrite, ethyl nitrite, ethyl chloride, etc.) are modified ampuls.

2. *Cataplasma, Cataplasmata* (cataplasms, poultices, Gr. καταπλάσσειν, to spread over).—Soft pasty masses to supply moisture and warmth locally in order to break down inflamed tissues; flaxseed meal, slippery elm, hop, bread and milk, kaolin and glycerin, bran, oatmeal, etc., answer well for these, to which either tincture of opium, aconite, arnica, or anodyne alkaloid may be added to lessen pain. The true poultice should be made by bringing the mass moistened with water or milk, to a boil, enclosing it in a cheese-cloth bag, and applying ½ to 1 inch thick over inflamed area; the addition of a little fixed oil or glycerin serves to retain heat and prevent caking, while a covering of oiled silk retains these properties much longer—kaolini (antiphlogistine).

3. *Charta, Chartæ* (papers).—Papers coated or saturated with some medicinal substance, to be used as a plaster or for burning—potassii nitratis, sinapis.

4. *Confectio, Confectiones* (confections, boluses, L. *conficere*, to put together).—Pasty masses of drugs triturated while hot (65° C.; 150° F.) with sucrose or honey—rosæ, sennæ.

5. *Curatio,-ones, Dressings.*—Ointment-like mixtures of powdered drugs heated with fatty base, stirred until beginning to congeal.

6. *Dentifricium,-a, Dentifrices* (tooth powders).—Finely powdered drugs—astringent, antiseptic, antacid, non-irritating, non-gritty; often saponaceous, sweetened and flavored.

7. *Dentilinimentum,-a, Dental Liniments.*—Refrigerant dental counter-irritant and liquid applications.

8. *Fluidglyceratum,-a, Fluid glycerates.*—100 p. c.; glycerin 50 p. c.; drug 100 Gm., glycerin 50 cc., water 150—moisten, macerate, complete percolation with chloroform water, reserve first 50 cc., evaporate second percolate to 60, mix, evaporate to 100 cc.

9. *Gargarisma, Gargarismata* (gargles).—Aqueous medicinal liquids for gargling the throat.

10. *Glycerogelatinum,-a, Glycerogelatins.*—Soft masses, melting at body temperature, containing medicinal material 10 p. c., glycerinated gelatin 10–20–30 p. c., glycerin 15–25–35 p. c., distilled water 35–65 p. c.; melt and apply to affected part with soft brush; substitute for cerates—dermatology.

11. *Inunctum,-a, Inunctions* (L. *inungere*, to anoint—rub into pores of skin).—Medicated ointments containing hydrous wool fat 85–95 p. c.

12. *Lavatio,-ones Ovi, Mouth Washes.*—Soap dissolved in 75 p. c. alcohol, colored and flavored with essential oils to please; antiseptic, purifier.

13. *Lotio, Lotiones* (lotions).—Mostly weak aqueous medicinal solutions or mixtures to be applied locally on linen, lint, or muslin.

14. *Mulla, Mullæ* (mulls).—Hard ointments (suet and lard base) spread on soft muslin or "mull," similar to plasters.

15. *Nebula,-æ, Sprays.*—Aqueous or oily (light liquid petrolatum) medicinal solutions to be used in atomizer or nebulizer for nares and throat.

16. *Olea Infusa, Infused Oils.*—Vegetable air-dried drug, 10 p. c.; macerate 6 hours in alcohol (10), ammonia water (.2), + sesame oil (100), heat, stir, strain, express, filter.

17. *Oleosacchara, Oil-sugars.*—Triturate the prescribed volatile oil 2 cc. with sucrose 100 Gm.

18. *Oxymel, Oxymella, Oxymellita.*—Honey 50, acetic acid 10, distilled water 10; gargle for sore throat, vehicle for expectorant nauseous medicines.

19. *Pastæ Dermatologicæ, Dermatologic Pastes.*—Ointment-like mixtures of starch, dextrin, sulphur, calcium carbonate, or zinc oxide, etc., made into a smooth paste with glycerin, soft soap, petrolatum, lard or other fats, medicated with antiseptic or astringent agents—dermatology.

20. *Petroxolinum,-a, Petroxolins.*—Solutions or mixtures of medicinal substances, 3–5–10–20–25–30–50 p. c., in liquid petrolatum—several having an additional small amount of oleic acid or hydrous wool fat.

21. *Sal-ia Effervescentia, Granular Effervescent Salts.*—Dried powdered chemical (chemicals) mixed with sufficient sodium bicarbonate and citric (tartaric) acid and granulated to cause effervescence when dissolved in water.

22. *Solutio,-ones, Solutions.*—Resinous substances, 20–60 p. c., dissolved in chloroform—for external use.

23. *Species, Species.*—The medicinal part of several species of plants mixed, cut, bruised, or reduced to coarse powder, sometimes including a chemical—for external or internal use—tea or poultice.

24. *Spiritus Oleorum Volatilium, Spirits of Volatile Oils.*—Any volatile oil, without formula, 6.5 cc. dissolved in alcohol 93.5 cc.

25. *Stili Medicamentorum, Medicated Pencils.*—Medicated agents made into plastic mass (paste) with starch, dextrin, tragacanth, sucrose, water, rolled into cylinders 5 Mm. ($\frac{1}{5}'$) thick, cut into sections 5 Cm. (2′) long, dried, wrapped in tin-foil—dermatology.

26. *Tabella,-æ, Tablets:* (*a*) *Tablet Triturates.*—Finely powdered drugs triturated with sucrose, lactose, or other soluble diluents, moistened with a volatile liquid (alcohol, water, syrup, etc.) then pressed lightly into molds and dried; (*b*) *Compressed Tablets*—pure or diluted drugs, dry and granular, with or without excipient, compressed in strong metal dies—these are harder, less friable and more slowly soluble.

III. Non-official.

1. *Abstracts, Abstracta.*—Powders having twice the strength of the vegetable substance, made by exhausting crude drugs, as a rule, with alcohol, recovering same, and incorporating residue with lactose.

2. *Acetic Fluidextracts, Fluidextracta Acetica.*—Solutions of the active constituents of organic drugs made with diluted acetic acid, and of the same strength as the official and semi-official fluidextracts.

3. *Bougies, Pencils.*—Small solid cylinders of gelatin, glyco-gelatin mass (white gelatin 3, glycerin 1), or oil of theobroma, impregnated with medicine, to be inserted into urethra, vagina, rectum, or nares.

4. *Cachets (de pain), Konseals, Wafers.*—Various-sized concave wafers made of unleavened bread (flour and water) or wafer-paper—the cavity formed by moistening the concave edges of two and pressing together containing the drug; when fastened, take by floating in a gulp of water.

5. *Capsules, Capsulæ.*—Various-sized, transparent casings (short tubes, usually with one open end fitting over that of another), of gelatin, hard or soft, for administering nauseous or disagreeable liquids or solids.

6. *Cigarettes.*—Have paper wrapper but filler of one or more medicinal substances—cubeb, stramonium, etc.

7. *Collyrium, Collyria, Eye-washes.*—Liquid applications for the eyes, composed usually of some astringent salt dissolved in rose water.

8. *Enemas, Enemata, Clysters.*—Liquids to be injected into the rectum. When large quantity (℥xvj–32; .5–1 L.), it is to act mechanically in emptying the bowel, and warm soapy or mucilaginous water answers the purpose; when small quantity (℥ij–4; 60–120 cc.), it is to act as a medicine or nutrient, and after injection—a towel pressed against the anus tends to aid retention, therefore absorption.

9. *Fomentations, Fomenta.*—Flannels wrung out of hot water and applied with or without medication.

10. *Gauzes, Carbasi.*—Gauze-muslin, free from sizing, saturated with a medicated solution of a definite strength, and then spread horizontally to dry.

11. *Granules.*—Very small sugar-coated pills, $\frac{1}{4}$–$\frac{1}{2}$ gr.; *Parvules (Dosi-metric)*, still smaller, and usually contain poisonous alkaloids or chemicals. *Dragée* (dra-zha)—name given in France to the ordinary sugar-coated pill.

12. *Injections, Injectiones.*—Usually aqueous solutions of vegetable drugs or alkaloids to be injected by a syringe into the rectum (enemas), under the skin (hypodermic), or into the urethral, nasal, aural, or vaginal tract. *Hypodermic Injections (Injectiones Hypodermicæ)* may be 1–5–10–33 p. c., and may have added, as a preservative, a small amount of either phenol, cresol, benzoic, hydrochloric, or salicylic acid.

13. *Inhalations, Inhalationes, Vapors, Vapores.*—Volatile liquid vapors breathed at ordinary inhalation, to act locally upon the respiratory mucous membrane.

14. *Insufflations, Insufflationes.*—Fine powders of active medicine, and mostly bland bases, to be blown into nares, larynx, throat, etc.

15. *Scales, Lamellæ.*—Thin scales, disks, or plates of medicinal substances; in England restricted to gelatin and glycerin, to be dropped into the eye, each weighing $\frac{1}{60}$ gr. (.0013 Gm.).

16. *Succus, Succi, Juices.*—Vegetable liquids expressed from fresh plants and preserved with alcohol.

17. *Wines, Vina* (L. *vinum*, wine).—Liquids differing from tinctures in being extracted with white wine, or a mixture of white wine and alcohol (20–25 p. c.)—antimony, ipecac.

The Avenues by and through which Medicines Enter the System.

1. *By Stomach: Gastro-intestinal Route.*—This is the most common and convenient method. After medicines are swallowed they enter circulation through the walls of the bloodvessels (which permeate the mucous membrane of the stomach and intestines), portal veins, and lacteals, so that when the intestinal contents reach the ileo-cecal valve they consist of excrementitious matter and food refuse. If the stomach be healthy and empty, crystalloids in solution quickly pass

through the vessel-walls, but colloids (albumin, fats, gelatin, gums, etc.) have to be digested and emulsified before they can be absorbed; the albuminous drugs (proteins) are transformed in the stomach by pepsin and gastric juice into soluble peptones, and there as such these, along with soluble crystalline salts, diffuse readily into the blood, often giving positive effect within an hour; the sugar, starchy, fatty, gummy, gelatinous, resinous, gumresinous and oleoresinous drugs, without suffering much change from the stomach secretions, pass into the duodenum, where the bile, intestinal and pancreatic juices, within 3–4 hours, convert the starches into sugar (which in part may go finally into lactic acid and fat), emulsionize and saponify the fats, oils, etc., separating them into glycerin and fat acids, the latter meeting alkaline bases, forming diffusible soaps; the resins, alone and in combination, within 4–10 hours, become broken up by these same alkaline juices (associated alkaline salts often facilitating), and either are converted into a soluble form for systemic ingestion, or simply are eliminated from the liver whose secretion (bile) they have stimulated, thereby being allowed to pass into the lower intestine to stimulate intestinal gland secretion, or to act somewhere along the tract as a local irritant or stimulant, thereby aiding peristalsis. All drugs taken from the intestinal canal have to pass through the liver before reaching general circulation, and in this passage they may become medicinally very much changed, modified, or even destroyed; again, some drugs may be excreted into the intestine along with the bile, and never reach further circulation, hence these disadvantages, along with that of required palatable form, preclude sometimes the adoption of this avenue.

2. *By Skin:*

1. *Hypodermic* (*Hypodermatic*).—This consists in injecting medicinal solutions (♏v–15; .3–1 cc.) into subcutaneous areolar tissue with a syringe (needle)—a method always more or less painful. Quick absorption here takes place by the lymphatics and capillary vessels, giving the advantage of full action of the quantity of drug used, without any possible changes from the intestinal secretions or processes; must here employ only clear, neutral (never acid), aqueous solutions of drugs, as otherwise intractable sores, sloughing, etc., might result around the punctures; must also avoid veins, injecting only on the external parts of the legs, thighs, arms, also abdomen, back, and buttocks (4 Cm.; $1\frac{3}{5}'$ behind the great trochanter). In the process of *hypodermoclysis* a sterilized trocar is employed, and several pints of saline solution ($\frac{7}{10}$–1 p. c.) injected, to antagonize, or to wash out and dilute any septic poison (uremia, septicemia), cholera-collapse, diabetic coma, shock, etc.; here insert trocar in subcutaneous tissue of abdomen or thigh, and control rate of flow alone by elevating or lowering the vessel containing the required amount of liquid; dissipate any tumefaction by careful massage; admit no air or foreign matters.

2. *Epidermic (Epidermatic).*—Here medicines are incorporated in wool fat, or other fats, and rubbed with friction directly upon the skin, thus promoting their passage through and between epidermal cells; best to apply where skin is thinnest (axillæ, groins, abdomen, insides of thighs) in the form of ointments, oleates, or oils. This method also is called *inunction.*
3. *Enepidermic (Enepidermatic).*—Here medicines are applied to the skin without friction; chloroformic and oleic acid solutions of the alkaloids (aconitine, atropine, morphine, strychnine) pass by osmosis most easily; solutions in a mixture of chloroform and alcohol nearly as fast; aqueous solutions slower, while pure alcohol causes an outward osmotic flow. In this way medicinal effect is secured through plasters and poultices.
4. *Endermic (Endermatic).*—Here we first produce a blister on the skin by the use of strong ammonia water (saturated cloths) or cantharides (cerate, collodion), then remove with scissors the epidermis, and apply upon the denuded surface (derma) the powdered medicine—morphine, atropine, quinine, strychnine, etc.; at present little employed.

3. *By Rectum.*—This is accomplished by enemas or suppositories, being suited best to disagreeable tasting alkaloids, acid solutions, etc. While absorption is usually twice as slow by this method as by the stomach, yet salts of atropine and morphine in solution enter circulation just as quickly, while those of strychnine more quickly than even by the mouth.

4. *By Lungs: Respiration.*—Vapors of liquids or solids are inhaled with the air, thereby bringing the system quickly under the drugs' influence; this quick action is due to the rapid absorption, owing to the extensive surface (lungs, etc.) to which applied, and to the fact that volatile substances penetrate the tissues most readily. Some vaporize at all ordinary temperatures, others at that of the body, while many have to be heated. Most anesthetics act by this method.

5. *By Arteries: Arterial Transfusion.*—Large quantities of fluid (defibrinated human or lamb's blood—℥iv–8; 120–240 cc., etc.) may be introduced into circulation, through the radial or posterior tibial, by the transfusion syringe. This is safer than by the veins, owing to the less likelihood of admitting air (causing fatal syncope) or of producing thrombosis, as the injected solution has to traverse the capillaries prior to reaching the right side of the heart, thus avoiding any likely sudden distention.

6. *By Veins: Intravenous Injection.*—This is the most perilous of all methods, being resorted to only in extreme emergencies to save life; thus blood or milk in hemorrhage, epilepsy, uremia, cholera-collapse; saline solutions in cholera-collapse, diabetic coma; diluted ammonia water, ether, brandy or whisky in bites of reptiles, venomous insects, hydrocyanic-acid poisoning, opium-narcosis, chloroform-asphyxia. It is better here to inject into a vein of the leg than of the

arm, so that the drug may be less concentrated when it reaches the heart, thereby avoiding possibly any cardiac depression.

7. *By External Application.*—Many powdered medicines when dusted on abraded surfaces, or applied by insufflation to the nares, fauces, larynx, become absorbed gradually, and affect the system locally and generally; this equally applies to drops and washes when introduced into the eyes and ears, also to atomized vapors, sprays, etc. The method known as *cataphoresis* consists of producing osmosis, through the skin or mucous membrane, from one point to another, of medicines by the galvanic current, the positive pole being medicated and placed over the affected part, the negative slightly remote; this is a mechanical action, and is accomplished by covering the seat of pain with a paper, linen, or gelatinous disk moistened with a solution of the drug, and placing thereon the anode, or may apply direct the sponge electrode saturated with the medicine; this method affects only tissues between the poles, and solutions of aconite, chloroform, cocaine, and morphine yield good results.

The Means by which Medicines are Transmitted through the System.

It was believed for a long time that drugs radiated from the seat of application throughout the system, by the nerves; this is known now to be false, and, instead, we recognize the blood to be the common carrier; thus the blood has to take up the drug in solution before there will be other than a local effect, and when once dissolved in it the periodic rounds of circulation are made regularly with this impregnation, so that the system, as a whole, responds to the medicine's influence. As proof of this, we find that blood taken from any portion of the body, near or far from the point of application, contains the drug; also the blood of persons poisoned when injected into others produces similar poisonous symptoms; if you interrupt the blood-circulation to any part, no poison will be transmitted to that part; as other secretions are nourished by the blood, you would expect them also to have similar medical properties, and such is the case—milk, sweat, urine, etc.; if we inject medicines directly into the blood (a dangerous process), we soon have characteristic action. The blood is enabled to absorb these through the intervention of the veins, lymphatics, and lacteals; while it eliminates them, even to the extent often of irritation, through the excretory organs, kidneys, bowels, skin, etc.

Conditions which may Modify the Action—Hence the Dose of Drugs.

Medicines are not given immediately before or after meals, unless certain conditions urgently demand it; they enter circulation much quicker on an empty stomach and then also produce best local results,

whereas a full stomach not only retards absorption, but renders poisons and irritating chemicals less injurious. The system is most resistent in the morning, when larger quantities of hypnotics, etc., are required than at night. The interval of doses depends upon rate of absorption and elimination of each drug, and usually should be sufficiently brief as to prevent the patient coming from under a continued influence until finally desired. Medicines change or modify directly the action only of those organs and tissues with which they come into immediate contact; this action may be simply local, or again general (systemic), and while all have one primary (direct) action, they may also produce indirectly (reflexly) one or more secondary (remote) effects.

The identical drug does not give rise to like results in every person, nor do different specimens of the same drug, when taken in equal quantities, produce the precise effects upon the one individual; for this there are several causes:

1. *Age.*—While the adult dose is about uniform (being based upon the average weight of 150 pounds; 68 Kg.), and holds good between the ages of twenty to sixty, yet that from infancy to majority is variable and should be computed by the following rules: Dr. Cowling's applies to any age up to and including the twenty-fourth year, and is thus: Divide the age at the next birthday by 24, and that fraction of the adult dose gives the quantity sought—child one year at coming birthday $= \frac{1}{24}$ of adult dose; gentian, gr. 30, hence $\frac{1}{24}$ of 30 = gr. $1\frac{1}{4}$. Dr. Young's applies to any age up to twelve years, and is thus: Divide the age at the coming birthday by that age plus 12—child two years at next birthday $= \frac{2}{2 + 12} = \frac{2}{14} = \frac{1}{7}$ of adult dose; cinchona, gr. 40, hence $\frac{1}{7}$ of 40 = gr. $5\frac{5}{7}$. Dr. Brunton's applies to metric doses, and is thus: Multiply the adult quantity by the approaching birthday, and that again by 4, then remove the decimal point two places to the left; adult dose of uva ursi is 1 Gm., and for a child five years old at its next birthday $= \frac{1. \times 5 \times 4}{100} = .2$ Gm.

Very old persons are extremely susceptible to strong or even ordinary medication, all doses having usually to be diminished. Children are very acute to opium and many anodynes, yet tolerate larger quantities of purgatives and a few other drugs (castor oil, calomel, rhubarb, cod-liver oil, iron, belladonna, ipecac, pilocarpine, squill, arsenic, chloral hydrate) than the rules would indicate.

2. *Mode of Administration.*—This has much to do with the rate of absorption, hence controls largely the dose. Thus the dose hypodermically is one-half that by the mouth, or one-fourth that by the rectum, and this difference depends upon the rapidity of absorption—the hypodermic being the quickest, the rectum the slowest; on a full stomach, medicines enter circulation much slower than on an empty one.

3. *Form of the Drug.*—This controls largely the rate of absorption, hence, the dosage. Before any substance enters circulation it must be in solution, and the nearer medicines approach the liquid form the quicker will they have effect and the smaller will be the doses required, consequently, it takes less in tincture than in powder or pill form.

4. *Condition of the Drug.*—The same species do not always produce drugs of uniform strength; thus cinchona, opium, nux vomica, rhubarb, senna, etc., are by no means regular, as the total alkaloids of cinchona may range from 2–10 p. c.; opium, 4–24 p. c., etc.; therefore, to have like results varying quantities must be given. This strength-difference is due largely to soil, climate, cultivation, season of year when collected, curing, duration on the market, possible adulterations, etc.

5. *Conditions of the Individual.*—These are not always the same; sex, race, temperament, idiosyncrasy, congenital tolerance, acquired tolerance (mithridatism), climate, occupation, imagination, mental emotion, disease, and habitual use all affect the dosage required in individual cases. Thus, females demand less than males; strong, burly races more than weaker ones; sanguine temperaments cannot tolerate stimulants; nervous temperaments must use purgatives cautiously; bilious temperaments need mercurials, while these are injurious to lymphatic temperaments. Idiosyncrasies vary in people—some vomit at the odor of ipecac or purge by smelling croton oil; others are affected little or greatly by opium, mercury, arsenic, belladonna, cocaine, iodides, etc. Warm climates demand smaller doses of purgatives and larger doses of antiperiodics. Occupation largely controls doses, as those exposed and under hard labor require unlike quantities to those in light pursuits, sedentary habits, indoor surroundings, etc. Imagination has its effect, as in a degree one's frame of mind can will or not will results. Mental emotion, either with or without disease, as a rule, demands larger doses than when free from any undue excitement. Habitual use lessens medicinal power, the dose having to be increased gradually, as with cathartics, opium, arsenic, etc. Disease modifies dose, as in tetanus, peritonitis, cancer, cholera, etc., excessive quantities of morphine are required and well tolerated; in typhoid fever abnormal amount of stimulants may be used, as alcohol, brandy, etc.; in pneumonia excessive doses of tartar emetic may be given without nausea, while during menstruation, lactation, pregnancy, etc., smaller doses should be administered.

6. *Incidental Conditions.*—Besides the preceding, we have some other factors influencing the variability of doses: State of the stomach, empty, full, active, sluggish, etc.—under certain disorders it will not assimilate medicines at all, when administration must be by other channels. Cumulative action of some drugs requires cautious doses; this may arise from slower elimination than absorption—mercury, lead, or the elimination may suddenly be arrested by the drug causing contraction of renal vessels, when the system has become saturated—digitalis, strychnine; or again, the intestinal contents may quickly be changed,

so that from a slow we get rapid absorption; rate of excretion modifies doses—when rapid, small and oft-repeated quantities are more advantageous than larger ones, and as an outgrowth of this we have now the praiseworthy tendency of diminished dosage, as with calomel, etc.; pathological conditions modify the effects of drugs very considerably; thus antipyretics in fever reduce temperature, but have no effect on it in health; bromides lessen convulsions in epilepsy, but depress very slightly the normal brain, etc.

7. *Untoward Effects.*—Many drugs produce other than their accustomed action upon certain individuals, made abnormal through habit or inheritance; such action results not from any drug impurity, but rather from the difference in the drug's primary and secondary effects (often opposite), the organs chiefly affected by the ordinary action of the drug, and the method of drug elimination. Thus an antipyretic, reducing temperature through the skin (this being connected with and controlled by the central nervous system regulating temperature), may produce skin eruptions or excessive perspiration (untoward)—the drug being eliminated by this channel; and as temperature cannot be controlled without, at the same time, controlling the vasomotor system regulating the blood supply, we also may have collapse, heart failure, palpitation, eye and ear symptoms. If drug is eliminated by kidneys we may have albuminuria, etc. (untoward); hypnotics acting on central nervous system may produce perspiration, skin eruptions, vertigo, heart collapse (untoward); astringents may occasion diarrhea, bloody intestinal discharges (untoward); diaphoretics from over-stimulation cause local pain, etc. (untoward). Thus aconite may produce eruption or itching of the skin; antipyrine—cyanotic hands, nose, lips, cold extremities; arsenic—dermatitis, burning of the skin, coryza; caffeine—insomnia, delirium, tremors, palpitation, tinnitus aurium, gastralgia; chloral hydrate—nausea, vomiting, purging, inflamed eyes; digitalis—nausea, indigestion, syncope; potassium iodide—coryza, acne; iron—gastric disturbance, headache, constipation; opium—wakefulness, nausea, vomiting, mental depression; pilocarpus—dim vision, vomiting, collapse, swollen salivary glands and tonsils, hiccough, strangling, salicylic acid—headache, tinnitus aurium, acne, blindness; cinchona—cinchonism, etc. Powerful drugs (tonics, alteratives, etc.), far more than those comparatively inert, tax the inherited and acquired deficiencies, while excessive and continuous strain on inhibitions usually produce affections of inhibitory apparatus as to modify greatly the untoward effects; these so vary in neurotics as often to cause such nerve-strain of eliminative and assimilative organs as to produce toxins, thereby intensifying or diverting drug's action—etiological moment.

8. *Incompatibility.*—This often changes the drug's action, producing harmless or harmful compounds, and may be of three kinds:

1. *Chemical.*—This results from double decomposition, new compounds being formed, and with the prescriber may be intentional or unintentional: from the former we may have lime water with mercuric

or mercurous chloride; zinc sulphate in solution with lead acetate; hydrochloric acid directly to potassium chlorate, etc.; in all these the new-formed product is the one desired medicinally; from the latter (unintentional) we may have glucosides (tannin, etc.) ordered with free acids, or emulsions; alkaloids with alkalies, alkaline salts, iodides or bromides; tannic and gallic acids with iron salts, alkaloids, tartar emetic, albumin, metallic oxides, gelatin; vinegars, acetic syrups, and diluted acid solutions with soluble carbonates; quinine sulphate with potassium acetate; corrosive mercuric chloride with alkalies, alkali carbonates, iodides, bromides, alkaloids, sulphides, reduced iron, silver nitrate, albumin, gelatin, tannin, etc. Any of the following with other substances should also be watched carefully, as they readily cause precipitation and changes: Chlorine solutions, corrosive mercuric chloride, iodine, iodides, lead salts, iron solutions, potassium acetate, bromide, and permanganate, solution of potassium hydroxide, tannic and gallic acids, diluted hydrocyanic acid, mineral acids, quinine sulphate, silver and zinc salts, tincture of guaiac, chlorates, iodates, picrates, nitrates, dichromates. The accompanying table is from Potter's *Materia Medica*, and serves an admirable purpose in this connection; P. stands for precipitate.

	Alkaloidal solutions (generally).	Metallic solutions (generally).	Solutions of lead or silver.	Solutions of calcium salts.	Solutions of magnesium salts.	Solutions of albumin or gelatin.
Alkalies	P.	P.	P.	P.	P.	
Tannic acid	P.	P.	P.	..	..	P.
Carbonic acid and carbonates	P.	P.	P.	P.	P.	
Sulphuric acid and sulphates	..	..	P.	P.		
Phosphoric acid and phosphates	P.	P.	P.	P.	P.	
Boric acid and borates	P.	P.	P.			
Hydrochloric acid and chlorides	..	..	P.			
Hydrobromic acid and bromides	..	..	P.			
Hydriodic acid and iodides	P.	..	P.			
Sulphides	..	P.	P.			
Arsenical preparations	..	P.	P.			
Albumin	..	P.	P.			

Explosions have resulted by mixing fluidextract of uva ursi or geranium with spirit of ethyl nitrite; chromic or nitric acid with glycerin; potassium permanganate with glycerin; silver nitrate with creosote; silver oxide with extract of gentian in pill; potassium chlorate with glycerin and tincture of ferric chloride; calcium chloride triturated with sulphur; oxidizing agents with sulphur, charcoal, iodine, phenol, glycerin, turpentine, etc.; iodine with ammonia; potassium chlorate with catechu. Poisonous compounds result from mixing potassium chlorate with its iodide, forming in the system potassium iodate; potassium chlorate with syrup of iodide of iron, liberating in the system free iodine; diluted hydrocyanic acid or potassium cyanide with calomel, forming corrosive mercuric chloride or mercuric cyanide.

2. *Pharmaceutical.*—This results when substances are mixed and do not produce clear solutions, owing to their different solubility in menstruums—insoluble powders or oil will not mix with water, nor will water with solutions of resins without precipitation—acid quinine solutions with glycyrrhiza solutions precipitate glycyrrhizin—alcoholic solutions with aqueous solution of chloral hydrate separate the latter on top. In all such cases it is better pharmacy to suspend the separated ingredients by the addition of a mucilage or some emulsifying agent. Under this head it is well to remember the following classes:

1. Alcoholic or resinous tinctures and fluidextracts, essential and fixed oils, copaiba, each precipitate with aqueous preparations.
2. Compound infusion of cinchona with compound infusion of gentian, and this latter with infusion of wild cherry.
3. Spirit of ethyl nitrite with strong mucilages, tincture of guaiac, solution of potassium bromide or iodide.
4. Alcoholic liquids, tinctures, and fluidextracts with those made with diluted alcohol; also with strong solutions of acacia.
5. Infusions in general with metallic salts—due to gelatinization and behavior of tannic acid.
6. Antipyrine with alkaloids, tincture of iodine, corrosive mercuric chloride, Lugol's solution, spirit of ethyl nitrite, ferric salts, hydrocyanic, tannic, and nitric acids, phenol, permanganates, salicylates, chloral hydrate, orthoform.
7. Pepsin with alkalies, alcoholic liquids, mineral salts, tannates, heat (100° C.; 212° F.).
8. Salicylic acid with iron compounds, alkali iodides, spirit of ethyl nitrite.

3. *Therapeutical.*—This results where two drugs of opposite medicinal properties are given together—the one neutralizing somewhat the other; astringents with purgatives; aconite or veratrum viride with digitalis; atropine, belladonna, hyoscyamus, or stramonium with caustic alkalies, pilocarpine, physostigmine (eserine), or morphine; acids with alkalies; arsenic with hydrated ferric oxide; phenol or lead salts with magnesium or sodium sulphate; cannabis with strychnine, picrotoxin, or acids; cocaine or gelsemium with morphine; conium with strychnine, picrotoxin, or stimulants; corrosive mercuric chloride with tannin or vegetable astringents; homatropine with physostigmine (eserine); opium and its alkaloids with potassium permanganate, belladonna, hyoscyamus, or stramonium; oxalic acid with calcium carbonate; silver nitrate with sodium chloride; strychnine or picrotoxin with chloral hydrate and potassium bromide; tartar emetic with tannin. Sometimes physiological antagonists are prescribed together purposely, in order to have the action of the one to guard that of the other, as atropine with morphine (hypodermically).

The Classifications of Medicines.

There have been many systems brought forward to facilitate the studying of drugs, and it is owing, possibly, to the number that authors observe little uniformity in the arrangement followed. It has been thought wise to outline the five most important, of which the first and fourth alone are by their nature sufficiently comprehensive to include all organic and inorganic drugs without any omissions. The others (three) are but scientific systems applicable only to the organic medicines, and, as such, are recommended mostly by pharmaceutical and chemical investigators.

I. Arrangement by Alphabetic Sequence.—This is the least scientific but the most popular; in fact, it is not a true system, as no tacit relationship in any particular exists between the associated subjects, save that of initial letter in spelling, which possibly can offer to the student only the trifling advantage of lexical convenience.

II. Arrangement by Chemical Constituents.—From a very early period organic drugs (vegetable and animal) were known to yield some of their activity to water and spirit, but the precise nature of the active constituents were little sought after until the beginning of the last century. The intelligent development of chemistry has been the means of separating these potentials and assigning their individual nature, to the extent of formulating a system or an arrangement of plants into groups dependent upon their chief constituent furnishing the medicinal properties, as: alkaloid, glucoside, fixed oil, volatile oil, resin, starch, etc. This classification, although best for the chemist in his laboratory investigation, somewhat assists the botanist, since certain genera and even families (natural orders) occasionally have similar constituents: Labiatæ (volatile oil), Solanaceæ (mydriatic alkaloids), Convolvulaceæ (cathartic resin), Rosaceæ (volatile oil, tannin), etc. Its great drawbacks consist in the variability of the nature assigned these constituents from time to time through the advance of chemical science: thus, a neutral principle today may be an alkaloid tomorrow; and, again, nearly all drugs have more than one constituent, the most abundant often being the least active, and which should govern its classification is not always easy to decide. To the general student, however, it is of considerable value, as it furnishes a knowledge of the character, name, and number of the possible drug constituents, also impresses the great difference between the crude drug and its active principle, and beyond all—that in every case it is the latter that furnishes the drug's working capacity.

1. *Amylaceous.*—Those containing starch as their chief medicinal principle: inula, lappa, cetraria, etc.

2. *Mucilaginous, Gummy.*—Those having considerable mucilage or gum: acacia, tragacanth, flaxseed, etc.

3. *Saccharine.*—Those containing much sugar, or related substance: manna, glycyrrhiza, triticum, etc.

4. *Acidulous.*—Those containing chiefly an organic acid: lemon, orange, tamarind, rubus, etc.

5. *Oleaginous.*—Those containing: (*a*) Volatile or essential oil: (1) Terpenes, $C_{10}H_{16}$: turpentine, cubeb, juniper, etc. (2) Oxygenated, $C_{10}H_{18}O$: cinnamon, anise, fennel, etc. (3) Sulphurated, $C_{12}H_{22}S_2$: mustard, asafetida, allium. (4) Nitrogenated, C_7H_6O (HCN): bitter almond, wild cherry, peach, etc. (*b*) Fixed oils (Compound ethers) which leave a permanent stain: olive, almond, castor oils, etc.

6. *Resinous.*—Those containing much resin: (*a*) Natural exudations: mastic, guaiac, benzoin. (*b*) Extracted by alcohol, etc., from resinous drugs: podophyllum, jalap, sumbul, etc.

7. *Gumresinous.*—These contain milky exudations consisting of one or more gums and resins: (*a*) With volatile oil: ammoniac, asafetida, myrrh, etc. (*b*) Without volatile oil: gamboge, scammony, etc.

8. *Oleoresinous.*—Those containing a volatile oil holding in solution a resin: turpentine, copaiba, Burgundy pitch, etc.

9. *Balsamic.*—Those containing a liquid, semi-liquid, or solid vegetable product composed of a resin or oleoresin, an odorous principle, and either one or both benzoic and cinnamic acids: Peru, Tolu, storax, etc.

10. *Glucosidal.*—These contain an organic principle converted by mineral acids, alkalies, or ferments into glucose and an allied organic compound; they may be neutral or acid, and sometimes form salts; nearly all are soluble in alcohol: salicin, gentiopicrin, cathartic acid, tannin, etc.

11. *Neutral Principles.*—These, sometimes called bitter principles from their bitterness, are plant-constituents, either neutral or feebly acid, and, when possible, form salts with alkalies; they differ from glucosides in not splitting into glucose, and from alkaloids in not being precipitated by tannin or mercuric-potassium iodide: aloin, elaterin, picrotoxin, santonin, etc.

12. *Alkaloidal.*—These contain alkaloids composed of carbon, hydrogen, and nitrogen alone, if liquid (amines), and additionally oxygen, if solid (amides); sometimes they are called vegetable alkalies, and, in fact, are related to ammonia, as when heated with alkalies ammonia is given off: quinine, morphine, cocaine, atropine, nicotine, coniine, etc.

III. Arrangement by Morphology and Anatomy.—This system is preëminently adapted for those wishing to become perfectly familiar with the general make-up of the various official plant-parts; the inner structural resemblances and differences of each group-member, as well as the relationship that each group itself sustains to its neighbors. In other words, it is most suited to laboratory work where time is afforded to make cross-sections, stainings, tests, dissections of fibro-vascular bundles, medullary sheaths, rays, etc., thereby readily

distinguishing the true and genuine article from that which is false and spurious.

1. *Roots, Radices:* (*a*) Monocotyledonous: sarsaparilla. (*b*) Dicotyledonous. (1) Fleshy: stillingia, sumbul, calumba. (2) Woody: glycyrrhiza, pareira, krameria, ipecac, etc.

2. *Rhizomes, Rhizomata:* (*a*) Cryptogamous: aspidium. (*b*) Monocotyledonous. (1) Without roots: ginger, calamus, triticum. (2) With roots: veratrum viride, cypripedium, iris. (*c*) Dicotyledonous. (1) Without roots: sanguinaria, geranium, podophyllum. (2) With roots: valerian, arnica, serpentaria, hydrastis, spigelia, etc.

3. *Tubers and Bulbs, Tubera et Bulbi:* (*a*) Monocotyledonous tubers: colchicum, salep, indian turnip. (*b*) Monocotyledonous tunicated bulbs: squill, garlic, etc. (*c*) Dicotyledonous tubers: jalap, aconite, corydalis.

4. *Twigs and Woods, Stipites et Ligna:* (*a*) Twigs: dulcamara, scoparius. (*b*) Woods: quassia, guaiacum, hæmatoxylon, etc.

5. *Barks, Cortices:* (*a*) Bitter and astringent: cinchona, wild cherry, viburnum. (*b*) Astringent: white oak, rubus, pomegranate. (*c*) Bitter, not aromatic; frangula, cascara sagrada, juglans. (*d*) Acrid or pungent: xanthoxylum, mezereum, euonymus. (*e*) Mucilaginous: ulmus. (*f*) Aromatic with oil- or resin-cells: cinnamon, sassafras, cascarilla, etc.

6. *Leaves and Leaflets, Folia et Foliola:* (*a*) Entire. (1) Aromatic, glandular, coriaceous: rosemary, pilocarpus, eucalyptus. (2) Not aromatic, glandular, or coriaceous: uva ursi, senna, coca. (*b*) Toothed or crenate. (1) Coriaceous: chimaphila, buchu, eriodictyon. (2) Not coriaceous: stramonium, hyoscyamus, digitalis, etc.

7. *Herbs, Herbæ:* (*a*) Cryptogamous: chondrus, cetraria, maidenhair, etc. (*b*) Dicotyledonous. (1) Petals distinct: pulsatilla, chelidonium, scoparius. (2) Petals united: eupatorium, lobelia, peppermint (Labiatæ). (3) Petals absent: cannabis.

8. *Leafy Tops, Cacumina, Summitates:* savine, red cedar, thuja, etc.

9. *Flowers and Petals, Flores et Petala:* (*a*) Unexpanded: clove, santonica. (*b*) Expanded. (1) Polypetalous: orange, kousso, rose. (2) Gamopetalous: Compositæ, sambucus, lavender, etc.

10. *Fruits, Fructus:* (*a*) Multiple: juniper, hop, fig. (*b*) Simple. (1) Drupes: phytolacca, cubeb, black pepper, prune. (2) Berries: lemon, capsicum, colocynth. (3) Achenes: barley, lappa, cannabis. (4) Cremocarps: Umbelliferæ. (5) Capsules: cassia fistula, cardamom seed, vanilla. (6) Parts of fruit: lemon, tamarind, etc.

11. *Seeds, Semina:* (*a*) Monocotyledonous (albuminous): sabadilla, colchicum, areca, etc. (*b*) Dicotyledonous. (1) Exalbuminous: almond, pumpkin, physostigma, mustard. (2) Albuminous: nux vomica, staphisagria, linseed, nutmeg, stramonium.

12. *Drugs with Cellular Structure:* (*a*) Not farinaceous: nutgall, ergot, mace, saffron, lupulin, lycopodium. (*b*) Farinaceous: starch, tapioca, barley, etc.

13. *Drugs without Cellular Structure:* (*a*) Extracts and inspissated juices, *Extracta et succi inspissati.* (1) Wholly or partially soluble in water or alcohol: guarana, opium, lactucarium, aloe, extract of glycyrrhiza, extract of hæmatoxylon, catechu, gambir, kino. (2) Insoluble in water or alcohol: gutta-percha, elastica, etc. (*b*) Sugars, *Sacchara:* sucrose, manna, honey. (*c*) Gums, *Gummata:* acacia, tragacanth, etc. (*d*) Gumresins, *Gummi resinæ.* (1) With volatile oil: asafetida, ammoniac, myrrh. (2) Without volatile oil: gamboge, scammony. (*e*) Resins, *Resinæ.* (1) Without benzoic or cinnamic acid: elaterium, mastic, rosin, guaiac. (2) With benzoic and cinnamic acids: benzoin, dragon's blood. (*f*) Balsams and oleoresins, *Balsama et oleoresinæ.* (1) Without benzoic or cinnamic acid: copaiba, turpentine, Burgundy pitch, pine tar. (2) With benzoic or cinnamic acid: Balsam of Peru, Tolu, storax. (*g*) Volatile oils and camphors, *Olea volatilia et camphoræ.* (1) Volatile oils—arranged in sequence of families (natural orders), containing a volatile portion, eleoptene, and a less volatile portion, stearoptene, or camphor: terpenes, oxygenated, nitrogenated, sulphurated. (2) Camphors: camphor, thymol. menthol, etc. (*h*) Fixed oils and waxes, *Olea pinguia et ceræ.* (1) Liquid fats: almond, olive, linseed, cod-liver, croton, castor oils. (2) Solid fats: oil of theobroma, lard, suet. (3) Waxes: spermaceti, wax.

14. *Drugs of Animal Origin:* (*a*) Animals: cantharides, cochineal, leech. (*b*) Animal products, tissues, secretions: eggs, isinglass, musk, pepsin, oxgall. (*c*) Calcareous skeletons and concretions: coral, cuttlefish bone, oyster-shell.

IV. Arrangement by Therapeutic Effect.—This is possibly the least difficult and most useful to the average physician. In a way it is scientific, but since many medicines possess more than one property with the same or varying dosage, it often becomes more or less confusing as to the group to which such should be assigned; then again this system has become somewhat flexible and lacking in perfect uniformity through the preferences of those giving it prior sanction. Thus all drugs may be placed into a dozen general classes, each with many subdivisions: those acting on protoplasm, muscle, nerves, spinal cord, brain, special senses, reproduction, circulation, digestive system, tissue-changes, excretion, generative system; or with no less equity the same number may be retained, but in substance somewhat modified, thus: drugs acting upon organisms, blood, cardiac mechanism, vessels, skin, urinary system, bodily heat, respiration, digestive apparatus, nervous and muscular systems, organs of generation, metabolism; or again the general classes may be omitted, simply using the names descriptive of the various therapeutic effects, arranged alphabetically, or according to real or fancied importance. From its universal favor and the usage of its terms throughout this work, we give yet another modification which has some advantages.

I. Agents Promoting Constructive Metabolism (Metamorphosis).

1. *Restoratives* (L. *restaurare*, to restore).—These restore or renew strength or vitality: (*a*) Foods, Aliments—which maintain some vital process, or renew some structural material, while medicines can modify only some vital action. They are derived from the vegetable, animal, and mineral kingdoms, and in Nature are recognized as being either: *oxidizable*—heat-producing and force-forming: carbon compounds, fat, sugar, starch, gum, etc.; *nitrogenous*—flesh-forming: albumin, casein, fibrin, etc.; *unoxidizable* or *incombustible:* metallic salts, water, etc.; (*b*) Digestive ferments—which are animal and vegetable substances for aiding digestion when the normal alimentary secretions are inefficient: pepsin, pancreatin, papain, diastase, ingluvin, etc.; (*c*) Digestive acids—which check the production of glands having acid secretions, but increase those having alkaline secretions: diluted hydrochloric, nitric, sulphuric, nitro-hydrochloric, lactic, phosphoric, etc.; (*d*) Fats and fatty oils—which form the molecular basis of the chyle, are indeed necessary for the digestion of nitrogenous food, and by oxidation become the chief producers of vital force and heat: cod-liver, cottonseed, linseed, olive, sweet almond, theobroma; (*e*) hematics (Gr. *αἱματικός*, of the blood)—which increase the amount of hematin in the blood, improving its quality by enriching the red corpuscles: salts of iron, manganese, chalybeate waters, etc.; (*f*) Tonics (Gr. *τονικός*, tone)—which improve the tone of specific tissues, restoring energy and strength to the entire debilitated system, by imperceptibly stimulating vital functions. (1) Mineral: phosphorus, phosphates, phosphites, bismuth, arsenic, etc. (2) Vegetable: (*a*) Simple Stomachic Bitters, containing a bitter principle: gentian, calumba, quassia, chirata, calendula; (*b*) Aromatic Bitters, containing a volatile oil, bitter principle, resin, tannin: serpentaria, wild cherry, eupatorium, anthemis, matricaria.

2. *Antiperiodics* (L. *anti*, opposed to, + *periodicus*, periodic, period).—These prevent recurrence of or modify certain periodic febrile diseases by arresting further development in the blood of successive crops of pathogenic organisms causing the disorder: cinchona alkaloids, eucalyptus, salicin, arsenic, etc.

3. *Antipyretics*, *Febrifuges* (Gr. *ἀντί*, against, + *πυρετός*, fever; L. *febris*, fever, + *fugare*, to put to flight).—These reduce abnormally high body-temperature, either by decreasing heat-production, or increasing heat-loss; the former condition being effected by (1) lessening tissue-change, (2) reducing circulation; the latter by (1) dilating the skin-vessels, thereby increasing radiation, (2) causing perspiration and its evaporation, (3) abstracting body-heat, through cold applications: cinchona alkaloids, acetanilid, antipyrine, acetphenetidin, phenyl salicylate, phenol, creosote, aconite, veratrum viride, cold bath, pack, or sponging, purgation, venesection.

4. *Antiphlogistics* (Gr. ἀντί, against, + φλογιστός, burning).—These reduce inflammation of serous membranes: mercury, opium, etc.; respiratory tract and organs: aconite, tartar emetic, etc.; and puerperal metritis: veratrum viride, ergot, cold, purgation, etc.

II. Agents Promoting Destructive Metabolism (Metamorphosis)—Increase Waste.

5. *Semi-alteratives, Alkalies.*—These, before meals, stimulate acid and check alkaline secretions when placed in contact with the mouths of the gland-ducts producing them; when administered after meals, they may be (1) Direct—which lessen the stomach's acidity. (2) Indirect—which have only a remote effect, being oxidized in the blood, and excreted as carbonates in the urine, thereby lessening its acidity; potassium carbonate and bicarbonate, solution of potassium hydroxide, sodium carbonate and bicarbonate, solution of sodium hydroxide, ammonium, lithium, and magnesium carbonates, magnesium oxide, solution of calcium hydroxide, calcium carbonate, aromatic spirit of ammonia, potassium and sodium acetates, potassium, sodium, and lithium citrates, potassium tartrate and bitartrate, vegetable acids.

6. *Alteratives.*—These alter or change morbid conditions, by furthering metabolism, and modify nutritive processes: iodine, iodides, arsenic, antimony, mercury, sulphur, sulphides, sulphites, phosphorus, sarsaparilla, guaiacum, mezereum, stillingia, colchicum, xanthoxylum, hydrastis, phytolacca, sassafras, cod-liver oil. Alteratives also are called *Resolvents* and *Discutients* (L. *resolvere*, to resolve, disperse; *discutere*, to disperse) from the fact that they promote absorption of inflammatory deposits, either by stimulating the lymphatic glands, or promoting the imbibition of medicinal or nutritive material in the system.

7. *Astringents* (L. *astringere*, to draw close, contract).—These contract muscular fiber by direct irritation (local), and condense other tissues by precipitating the albumin and gelatin (remote). 1. Mineral: salts of silver, copper, lead, zinc, bismuth, and aluminum. 2. Vegetable: tannic and gallic acids, nutgall, white oak, geranium, gambir, catechu, kino, krameria, hæmatoxylon, hamamelis, red rose, uva ursi.

III. Agents Promoting the Destruction of Microbes, Parasites, etc.

8. *Antizymotics* (Gr. ἀντί, against, + ζυμωτικός, fermentation).—These arrest fermentation dependent upon organic ferments (enzymes): diastase, pepsin, ptyalin; or upon organized ferments: yeast, bacteria, etc.: (*a*) *Antiseptics* (Gr. ἀντί, against, + σηπτικός, rottening)—which prevent or retard septic decomposition, by killing the bacilli producing it, or by arresting their development: corrosive mercuric chloride, hydrogen peroxide, potassium permanganate, sulphurous acid, phenol,

cresol, creosote, lysol, thymol, eucalyptol, menthol, sodium borate, boric acid, chlorine, zinc chloride; (*b*) *Disinfectants* (L. *dis*, *di*, in two, apart, from, + *inficere*, *infectus*, infect(ion)—which destroy specific germs communicating disease (mostly microbes), by (1) acting as oxidizants, (2) combining with albumin, (3) chemically combining to form substitution-compounds, (4) arresting molecular changes, (5) altering the reaction of the media containing the germs: heat (110–121° C.; 230–250° F.), lime, chlorinated lime and soda, ferrous sulphate, zinc chloride, potassium permanganate and dichromate, sulphurous and nitrous acids, sulphur dioxide, formaldehyde, air, water, fire; (*c*) *Deodorants* (L. *de*, from, + *odorare*, *odoran(t)s*, smelling)—which destroy foul odors. These may be volatile (oxidizing and deoxidizing) agents, that act chemically on obnoxious gases: chlorine, sulphur dioxide, hydrogen dioxide, formalin; or non-volatile (chiefly absorbents) agents that act by condensing and decomposing the effluvia: potassium permanganate, charcoal, earth, lime, ferrous sulphate, etc.

9. *Parasiticides, Germicides* (Gr. παρά, besides, upon, + σιτεῖν, to feed; L. *parasitus*, parasite, + *cædere*, to kill).—These kill animal and vegetable parasites existing upon the system, being applied usually in the form of lotions, solutions, washes, ointments, and oleates: staphisagria, corrosive mercuric chloride, mercuric nitrate and oxide, ammoniated mercury, sulphur, sulphur iodide, phenol, iodoform, thymol iodide, resorcinol, naphthalene, betanaphthol, creosote, guaiacol.

IV. Agents Acting on the Nervous System (Neurotics, Nervines).

10. *Cerebral Excitants, Stimulants, Antispasmodics* (L. *stimulare*, *stimulus*, to urge, stimulate, a goad, excitant; Gr. ἀντί, against, + σπασμός, a spasm).—These increase the functional activity of the brain without causing subsequent depression or suspension of the cerebral functions: valerian, asafetida, sumbul, musk, camphor, guarana, caffeine (theine), alcohol.

11. *Cerebral Depressants, Sedatives* (L. *sedare*, *sedatus*, to allay, calm, a pacifier, tranquillizer).—These lower or suspend the higher brain functions after a preliminary stage of excitement: (*a*) *Narcotics* (Gr. νάρκη, numbness, stupor)—which at first excite and stimulate all the body functions, then cause profound sleep, stupor, coma, insensibility, and death by paralyzing the medulla-centers governing respiration and other vital functions: opium, morphine, cannabis, lactucarium, cimicifuga; (*b*) *Hypnotics, Soporifics, Somnificants* (Gr. ὕπνος, sleep; L. *sopor*, heavy sleep, *somnus*, sleep, + *facere*, to make)—which produce sleep, leaving undisturbed the normal relationship of the mental faculties to the external world; in a broad sense these include narcotics and anesthetics: chloral hydrate, sulphonmethane, sulphonethylmethane, paraldehyde, chloralformamide, urethane, potassium, sodium, and ammonium bromides; (*c*) *Anodynes, Analgesics* (Gr. ἀν,

not, + ὀδύνη, ἄλγος, pain, without pain, cures pain)—which relieve pain by either depressing sensory centers or impairing nerve-fiber conductility: opium, morphine, belladonna, hyoscyamus, stramonium, coca, cocaine, hop, antipyrine, acetanilid, acetphenetidin; (*d*) *Anesthetics* (Gr. ἀν, not, + αἰσθητός, sensible, insensible effect produced)—which reduce sensory nerve-functions until nerves cannot receive or conduct sensation; some directly depress the skin's end-organs, others impair the sensory nerve conductility, others reduce local circulation; these are mostly volatile substances, whose vapor when inhaled sufficiently causes complete unconsciousness, loss of sensation and motion; anodynes only diminish, while anesthetics temporarily destroy skin and mucous membrane sensibility: ether, chloroform, nitrous oxide, ethyl bromide, methylene bichloride.

12. *Motor Excitants* (*Excito-motors, Spinants*).—These increase functional activity of the motor apparatus and spinal cord, causing, in large doses, disturbances of motility, increased reflex excitability, and tetanic convulsions, finally paralysis from over-stimulation: nux vomica, strychnine, ignatia, picrotoxin, electricity.

13. *Motor Depressants* (*Depresso-motors*).—These lower functional activity of the motor apparatus and spinal cord, in large doses directly paralyzing them: physostigma, conium, gelsemium, potassium, sodium, ammonium, and lithium bromides, amyl nitrite, nitroglycerin, lobelia, alcohol, ether, chloroform.

14. *Mydriatics* (Gr. μυδριάσις, enlarged pupil).—These dilate the pupil; some act locally, others systemically, causing paralysis of the ciliary muscle: atropine, homatropine, hyoscyamine, daturine, duboisine, cocaine.

15. *Myotics* (Gr. μύειν, to close, shut).—These contract the pupil by stimulating the circular muscular fibers of the iris, and by contracting the ciliary muscle so that the eye is accommodated only for near objects: physostigmine, pilocarpine, morphine, anesthetics (at first), muscarine.

V. Agents Acting on the Respiratory System (Respiration).

16. *Respiratory Stimulants.*—These exalt the functions of the respiratory center in the medulla, affording deeper and quicker breathing: strychnine, atropine, digitalis, apomorphine, duboisine, emetine, opium (small doses).

17. *Respiratory Sedatives* (*Depressants*).—These lower the respiratory center's activity, affording shallow and slow respirations: opium, physostigma, gelsemium, aconite, veratrum viride, conium, muscarine, hydrocyanic acid.

18. *Pulmonary Sedatives* (Gr. πλεύμων, πνεύμων, lung; L. *pulmonarius*, pertaining to or affecting the lungs).—These lessen the irritability of the respiratory nerves or center, thereby diminishing cough and dyspnea. Some directly depress the center, others remove irritating

substances from the passages, others lessen local congestion, others lower the excitability of the vagus end-organs and afferent filaments of the lungs and respiratory tract: opium, morphine, codeine, hydrocyanic acid, belladonna.

19. *Sternutatories, Errhines* (L. *sternutare*, to sneeze; Gr. ἐν, in, + ῥιν, the nose).—The former cause sneezing; the latter increase nasal secretion when applied to mucous membrane in powdered form: ipecac, quillaja, ammonia, cubeb, etc.

20. *Ciliary Excitants* (L. *cilium*, an eyelid, hair-like process).—These, when dissolved in the mouth, promote bronchial mucous expectoration through reflex excitation of the bronchial and tracheal cilia: acacia, ammonium and sodium chlorides, potassium chlorate.

21. *Expectorants* (L. *ex*, out of, + *pectus, pectoris*, the breast).—These change the broncho-pulmonary mucous membrane secretion, promoting its expulsion: (*a*) Nauseating (Sedative)—which, in large doses, cause vomiting, thereby acting mechanically in expelling the mucus, and, in small doses, increase osmosis from the inflamed mucous membrane; they may increase secretion and lower blood-pressure: tartar emetic, ipecac, apomorphine, lobelia, pilocarpus; (*b*) Stimulating—which stimulate the bronchial mucous membrane that eliminates them, altering the secretion and facilitating expectoration: senega, squill, ammonium carbonate and chloride, benzoin, balsam of Peru, Tolu, pine tar, turpentine, garlic, onion, glycyrrhiza, saccharine substances, ammoniac.

VI. Agents Acting on the Circulatory System (Circulation).

22. *Cardiac Stimulants* (*Tonics;* L. *cardiacus;* Gr. καρδία, heart).—These stimulate the cardiac muscle, slowing and strengthening its contractions; excessive quantities may cause sudden death by syncope: digitalis, strophanthus, scoparius, convallaria, cimicifuga, nitroglycerin, nitrites, alcohol, ether, ammonia, heat, galvanism, chloroform.

23. *Cardiac Depressants* (*Sedatives*).—These lessen the force and frequency of the heart's action, controlling its over-action and palpitation; especially do they slow the pulse in sthenic fevers due to local inflammation: aconite, veratrum viride, tartar emetic, senega, pilocarpine, hydrocyanic acid, emetine, quinine (full doses), pulsatilla, grindelia, cold.

VII. Agents Acting on the Digestive System (Digestion).

24. *Sialagogues* (Gr. σίαλον, saliva, + ἄγειν, ἀγωγός, to lead, leading forth).—These promote the secretion and flow of saliva and buccal mucus: (*a*) Topical—which act through reflex irritation, caused by taking something into the mouth: capsicum, ginger, cubeb, mustard, tobacco, pyrethrum, horse-radish, alkalies; (*b*) General—which act

through systemic influence on the glands or their secretory nerves during the drug's elimination: pilocarpus, mercurials, antimonials, iodine compounds, physostigma.

25. *Refrigerants* (L. *refrigerare*, to cool).—These allay thirst, giving the sensation of coolness: vegetable and mineral acids (diluted), fruit juices, ice-water, effervescing drinks, diaphoretics.

26. *Dental Anodynes.*—These are used locally in toothache due to caries, thus exposing a nerve filament: aconite, cocaine, opium, morphine, phenol, creosote, oils of clove and peppermint, chloral hydrate.

VIII. Agents Acting on the Excretory System (Excretion).

27. *Carminatives, Aromatics* (L. *carminare, carminativus*, to expel wind).—These expel gases from the stomach and intestines by increasing peristalsis, stimulating the circulation, and relaxing the cardiac and pyloric orifices; also act as diffusible stimulants to the body and mind: cardamom seed, capsicum, ginger, peppermint, spearmint, cinnamon, nutmeg, lavender, calamus, orange, anise, caraway, coriander, fennel, pimenta, pepper, mustard, clove, asafetida, and volatile oil of each.

28. *Emetics* (Gr. ἔμετος, vomiting).—These cause vomiting: (*a*) Local—which, by reflex action, irritate the end-organs of the gastric, pharyngeal, or esophageal nerves: zinc and copper sulphates, mercury subsulphate, alum, mustard, tepid water; (*b*) Systemic (General)—which act by directly stimulating the vomiting-centers through circulation: ipecac, apomorphine, tartar emetic, senega, squill, lobelia, sanguinaria, compound syrup of squill.

29. *Antiemetics.*—These lessen nausea and vomiting: (*a*) Local—which produce a sedative action on the end-organs of the gastric nerves: ice, phenol, bismuth subnitrate and subcarbonate, cerium oxalate, creosote, small doses of calomel or ipecac, hot water, opium, cocaine; (*b*) General—which act by reducing the irritability of the vomiting-center in the medulla: opium, bromides, morphine, codeine, chloral hydrate, alcohol, amyl nitrite, food, brandy.

30. *Cathartics, Purgatives* (Gr. καθαρτικός, cleansing; L. *purgare*, to cleanse).—These increase or hasten intestinal evacuations: (*a*) *Aperients, Laxatives* (L. *aperiere*, to open; *laxare*, to loose)—which excite moderate peristalsis, giving soft movements without irritation: magnesia, manna, sulphur, tamarind, almond and olive oils, fig, prune, oatmeal; (*b*) *Simple Purgatives*—which cause active peristalsis and stimulate secretion of the intestinal glands, giving one or more copious, semi-fluid movements accompanied by some irritation and griping: aloe, calomel, castor oil, cascara sagrada, rhubarb, senna, small doses of salines, drastics, cholagogues; (*c*) *Saline Purgatives*—which stimulate the intestinal glands, increase peristalsis and osmosis, causing watery stools: magnesium sulphate and citrate, potassium sulphate, tartrate and bitartrate, sodium sulphate, phosphate and chloride, potassium and sodium tartrate; (*d*) *Drastic Purgatives* (Gr. δράω,

δραστικός, to act, active).—These often are called simply cathartics, and act more intensely than the preceding, causing violent peristalsis, watery stools, griping, tenesmus, borborygmus, mucous membrane irritation, and exosmosis of serum; large doses become irritant poisons: colocynth, jalap, gamboge, scammony, croton oil; (*e*) *Hydragogue Purgatives* (Gr. ὕδωρ,, water, + ἄγειν, ἀγωγός, to lead, leading forth)—which remove much water from the vessels: croton oil, elaterium, gamboge, potassium bitartrate, large doses of salines and drastics; (*f*) *Cholagogue Purgatives* (Gr. χολή, bile, + ἄγειν, ἀγωγός, to lead, leading forth)—which stimulate bile flow, causing free purgation of green-colored (bilious) and liquid stools: mercurials, aloe, rhubarb, podophyllin, euonymin, iridin, leptandrin.

31. *Diuretics* (Gr. δία, through, + οὐρεῖν, to urinate).—These increase renal secretion, either by raising the local or general blood-pressure, thereby increasing renal circulation (blood-supply), or by stimulating the secreting cells or nerves of the kidneys, or by washing out the kidneys with much water taken at night or early morning; (*a*) Refrigerant—which excite the renal epithelium, producing a hyperemic condition of the kidneys and an increased amount of water in the urine; they depress the heart and general circulation: potassium acetate, citrate and bitartrate, ammonium and sodium acetates, lithium carbonate and citrate, magnesium citrate and sulphate, water, milk, cold applications; (*b*) Hydragogue—which largely increase the amount of water in the urine, owing to raising arterial pressure, locally or generally: digitalis, strophanthus, spirit of ethyl nitrite, nitrites, squill, cimicifuga, scoparius; (*c*) Stimulant (blennorrhetics)—which act directly upon the renal tissue, by which they are to a great extent eliminated from the body: buchu, copaiba, cubeb, matico, pareira, uva ursi, savin, juniper, chimaphila, taraxacum, cantharides, turpentine, oil of santal, corn silk, apocynum.

32. *Antilithics, Lithotriptics* (Gr. ἀντί against, + λίθος, stone, + τρίβειν, to rub).—The former prevent the formation of urinary and biliary concretions in the excretory passages; the latter dissolve them when formed: *biliary calculi:* alkaline waters, turpentine, etc.; *vesical calculi:* (1) uric acid or urates: alkaline salts, magnesium citro-borate, etc.; (2) calcium oxalate: acids, carbonated waters, etc.; (3) phosphatic deposits (calculi): ammonium benzoate, nitric acid, etc.

33. *Diaphoretics, Sudorifics* (Gr. δία, through, + φορεῖν, to carry; L. *sudor*, sweat, + *facere*, to make).—These increase the action of the skin, causing sweat-secretion; are called sudorifics when the secretion is so profuse as to form beads on the surface: (*a*) Simple—which enter circulation and stimulate the sudoriferous glands, by which they are eliminated: pilocarpus, ammonium acetate and citrate, sarsaparilla, guaiacum, mezereum, sassafras, senega, serpentaria, salicylates; (*b*) Nauseating—which relax and dilate the superficial capillaries: ipecac, tartar emetic, opium, Dover's powder, alcohol, ether, spirit of ethyl nitrite, lobelia, tobacco, vapor and Turkish baths, wet-pack, hot drinks;

(*c*) Refrigerant—which reduce circulation by acting on the sweat-centers in the spine and medulla: potassium citrate, aconite, veratrum viride, tobacco, lobelia, pilocarpus, spirit of ethyl nitrite, opium.

34. *Antihydrotics, Anhydrotics* (Gr. ἀντί, against, ἀν, not, + ἱδρώς, sweat).—These check perspiration by reducing the action of the sweat-glands, or the excitability of the sweat-centers, or the circulation in the skin: belladonna, chloralformamide, muscarine, pilocarpine, strychnine, quinine, etc.

35. *Anthelmintics* (Gr. ἀντί, against, + ἑλμινθ, a worm).—These destroy (*Vermicides*, L. *vermis*, worm, + *cædere*, to kill) or expel (*Vermifuges*, L. *vermis*, worm, + *fugare*, to put to flight) intestinal worms. Vermifuges: castor oil, jalap, scammony. Vermicides, for: (*a*) Thread worms (*Oxyuris vermicularis*): vegetable astringents, alum, iron sulphate, aloe, tannin, lime water, quassia, all by enema; (*b*) Round worms (*Ascaris lumbricoides*): santonin, spigelia, chenopodium, each in combination with either calomel, castor oil, senna, or compound powder of jalap; (*c*) Tape worms (*Tænia solium* +) *Tænifuges:* aspidium, kamala, kousso, pomegranate, pumpkin seed, turpentine.

IX. Agents Acting on the Reproductive System (Generation).

36. *Emmenagogues* (Gr. ἔμμηνος, monthly, + ἄγειν, ἀγωγός, to lead, leading forth).—These restore the menstrual function, either by stimulating directly the uterine muscular fiber or indirectly enriching the blood, thus toning up the nervous system: (*a*) Direct—which act locally on the uterus: ergot, rue, tansy, savin, cantharides, myrrh, guaiacum, apiol, hedeoma, cimicifuga, caulophyllum, pulsatilla, potassium permanganate; (*b*) Indirect—which act generally on the system: iron, manganese, quinine, strychnine, aloetic purgatives, tonics, hot hip baths, cod-liver oil.

37. *Ecbolics, Oxytocics* (Gr. ἐκ, out of, + βάλλειν, to throw out; ὀξύς, quick, + τόκος, birth).—These stimulate the muscular fibers of the gravid uterus to contraction, thus causing premature birth or abortion: ergot, cottonroot bark, savin, hydrastis, potassium permanganate, oils of rue, tansy, and pennyroyal.

38. *Aphrodisiacs* (Gr. Ἀφροδίτη, Venus, Greek goddess of love, venereal).—These stimulate sexual appetite and power by acting reflexly or directly upon the cerebral or spinal genital center: damiana, phosphorus, cantharides, tonics, ergot, meat diet, strychnine, cannabis, alcohol.

39. *Anaphrodisiacs* (Gr. ἀν, not, + Ἀφροδίτη.—These lessen sexual functions and appetite, by diminishing excitability of the nerves of the genital organs, also by depressing the genital centers in the brain and spine, and by decreasing local circulation: bromides, camphor, opium, tobacco, purgation, venesection, cold baths, ice, vegetable diet, cocaine, belladonna.

40. *Galactagogues* (Gr. γάλα, milk, + ἄγειν, ἀγωγός, to lead, leading forth).—These increase lacteal secretion: pilocarpus, ricinus (leaves locally), thea (internally with alcohol, beer, porter), etc.

X. Agents Acting on the Cutaneous System (Skin).

41. *Irritants, Counter-irritants.*—These when applied to the skin cause vascular excitement; are called counter-irritants when used to produce reflex influence on remote parts: (*a*) *Rubefacients* (L. *rubere*, to be red, + *facere*, to make)—which produce temporary redness and skin congestion; if left on too long, may cause exudation between the cuticle and true skin (vesicants), or may destroy the tissue, forming a slough (escharotics), or may cause muscular atrophy: mustard, capsicum, mezereum, iodine, menthol, ammonia, arnica, volatile oils (turpentine, cajuput, etc.), hot water, friction; (*b*) *Vesicants, Epispastics, Blisters* (L. *vesica*, a blister; Gr. ἐπί, upon, + σπᾶν, to draw)—which produce much inflammation of the skin and effusion of serum between the epidermis and derma: cantharides, mezereum, iodine, rhus toxicodendron, glacial acetic acid, volatile oil of mustard, steam, boiling water, ammonia vapor; (*c*) *Pustulants* (L. *pustulare*, to blister)—which cause pustules, and affect isolated parts of the skin, as orifices of sudoriferous glands: croton oil, tartar emetic, silver nitrate; (*d*) *Escharotics, Caustics* (Gr. ἐσχάρα, a scab, scar)—which destroy tissue when applied, by abstracting its water, or by combining with the albumin of the skin, or by corrosive deoxidation of the tissues, thus causing a slough: mineral acids, phenol, chromic acid, lime, potassium and sodium hydroxides, dried alum, silver nitrate, zinc chloride, copper sulphate, corrosive mercuric chloride, mercuric oxide and nitrate, bromine, high heat, electric cautery, boiling water, arsenic trioxide.

42. *Styptics, Hemostatics* (L. *stypticus*, contracting; Gr. αἷμί, blood, + ἱστάναι, στατικός, to stop, stopping).—These arrest hemorrhage; the former being used locally, the latter internally. Some act mechanically, by closing the mouths of the bleeding vessels with a blood-clot; others contract the vessels, thus checking the blood-flow: (1) acids, alum, collodion, ferric chloride and sulphate, silver nitrate, matico, tannin, lead acetate, zinc sulphate, vegetable astringents, cold (locally), electric cautery; (2) ergot, gallic acid, matico, lead acetate, diluted sulphuric acid, hamamelis, oil of turpentine, heat (locally).

43. *Emollients* (L. *emollire*, to soften).—These soften and relax the tissues when applied locally, diminish the tension and pressure on the nerves, dilate the vessels, and protect inflamed surfaces: poultices, fatty oils, lard, spermaceti, glycerin, petroleum, starch, soap liniment, oil of theobroma.

44. *Demulcents* (L. *demulcere*, to soothe).—These, usually mucilaginous or oleaginous, are intended for soothing parts to which applied, being restricted generally to mucous membranes (internally), and emollients to the skin (externally): acacia, cetraria, starch, flaxseed,

glycyrrhiza, gelatin, honey, althea, egg-white, tragacanth, olive and other bland oils.

45. *Protectives.*—These are mechanical coverings to protect various injured parts from air, water, friction, etc.: collodion, plasters, etc.

V. Arrangement by Natural Affinities (Botanical).—This system is the one adopted throughout this work. It is of all others the most scientific by which plants may be studied, and, as the official portions of vegetable drugs are but parts of the whole, it seems only natural that the parental source should furnish the basis of classification for these medicinal parts. Everyone knows that there are greater similarities and dissimilarities between some plants than between others, and that this likewise applies to animals. Scientists, taking advantage of this fact, have for several centuries been trying to form groups of plants, each to contain only those possessing, in common, certain marks of resemblance, and so naming the same, when possible, to typify the strongest characteristic. Early botanists were content with one point of agreement, but they differed even as to what plant-organ, above all others, should be accepted to furnish this point, hence the basis of a system. Cæsalpinus (1519–1603) selected the fruit, the globular furnishing one class, the flat another, etc. Tournefort (1656–1708) took the flower, restricting himself to the modification and arrangement of the corolla, the cup-shaped being one class, the bell-shaped another, etc. Linnæus (1707–1778) went a step further, and founded classes and orders upon the position, number, and relative lengths of the stamens and pistils, giving us the Linnæan, artificial, or sexual system of plants. This worked very well until cultivation, climatic differences, etc., changed the number of stamens and pistils. So far, no one had taken into consideration the plant's entirety. It is to John Ray (1628–1705), often called the "father of English natural history," that we owe the conception of a broader and more natural system; but it was Jussieu (1748–1836) who, embodying the grand features of both Ray and Tournefort, laid the permanent foundation of the true natural system which, somewhat modified, has come down to us. The very foundation of this system necessitates the faithful consideration of the similarities in form, structure, growth, habits, functions, thereby involving the idea of "affinity in essential organs." These understood, we may arrange the entire vegetable kingdom into allied groups of a scaling grade, dependent upon their whole make-up, thus placing each family (natural order), genus, and species next to those it most resembles in all respects.

Families or Natural Orders.—Of these there are about 280; they are the broader groups, and each comprises plants resembling one another in some strong particular, which applies to them generally as a class; this characteristic usually is taken from one of the reproductive organs (flowers, fruit, seed), and is so striking as to be noticeable by the inexperienced: Leguminosæ (fruit in legumes), Umbelliferæ (flowers

in umbels), Compositæ (flowers compound), Labiatæ (corolla 2-lipped), Cupuliferæ (fruit in cupule), Guttiferæ (juice exudes in drops), Coniferæ (fruit in cones), Cruciferæ (petals arranged like a Maltese cross), etc.

Genus, Genera.—Of these there are about 10,000; they are more restricted groups, and go to compose the families or natural orders. This name corresponds to the family, surname, or last name of persons, Brown, Jones, Smith; it is a noun, and, like the family (ordinal) name, begins with a capital. Genera also are grouped according to some certain but more restricted characteristic taken from the reproductive organs; hence a genus is a collection of species resembling one another in the structure and general characters of the organs of reproduction, or in reproductive processes, methods of fructification, pollination, etc. Plants of the same genus are expected to be on the same numerical plan, and to have flowers, constituents, and medicinal properties somewhat similar.

Species, Species.—Of these there are about 200,000; they are the most restricted permanent groups and make up the various genera. This name corresponds to the baptismal or first name of persons, James, John, William; it is usually an adjective agreeing in case and gender with generic name, and, as such, should begin with a small letter. These are grouped according to some certain but still more restricted characteristics taken usually from the vegetative organs (root, stem, leaves), as color, proportion, shape, surface, duration, division, etc.; hence, species is a succession of individuals which reproduces and perpetuates itself. The last two names, generic and specific, when taken together, constitute the plant's name—*i. e.*, botanical source or origin—and consequently every plant (and animal) thus always is designated.

There are two scientific methods (with their many modifications) of arranging each family (natural order), genus, and species toward its nearest neighbor. Thus we may follow Jussieu's sequence, beginning with the cellular, flowerless, or lowest plant-life (Algæ), advancing to those of vascular structure, with apologetic, imperfect, or incomplete floral parts, always having each to follow in the ascending scale, finally reaching those producing as then understood the most perfect, complete, and typical flowers (Ranunculaceæ). De Candolle (1778–1841) greatly innovated this system, but chiefly in reversing the arrangement, placing the most highly organized plants, or flower producers, first in order, and each lower one in a descending succession. This would seem the most unnatural, as the order of development in Nature surely suggests evolution from forms more simple to those more complex, and not the converse. In spite of this, however, it was universally accepted up to the latter part of the last century, being strongly indorsed and followed by many of the world's greatest botanists, including Bentley, Trimen, Hanbury, Gray, Balfour, Bentham, Hooker, etc.; and is enunciated best by Bentham and Hooker in their *Genera Plantarum.*

The other plan, being the most rational, has continued always to have supporters, and during the past three decades has been studied systematically and thoroughly, especially in Germany, with more than ordinary zeal and results. Such scholars as Eichler, Engler, Prantl, Gilg, Thomé, Potonié, Richter, Flückiger, Köhler, Strasburger, Schenck, Schimper, etc., have instituted many changes, and, although beginning with the most primitive plant-life and ending with those bearing most complex flowers (Compositæ), have succeeded in evolving the system in a form much more consistent and in harmony with modern scientific thought and general plant-nature. As such, it is enunciated best by Engler and Prantl in their *Die Natürlichen Pflanzenfamilien*, and by Engler in his *Syllabus der Pflanzenfamilien*, and as this is the sequence that necessarily must come into future favor, it has been thought wise, in the main, to adhere to it in this work, giving thereto the following synopsis:

SUB-KINGDOM I. **THALLOPHYT(ES)-A.**

CLASS 1. **ALGÆ.**

1. *Gelidiaceæ.*—Distinguished by being parenchymatous or cartilaginous plants, growing in fresh or salt water, or moist places, red, purple, violet, occasionally green or black—chlorophyll being masked by phycoerythrine (red); composed of many species. *Gelidium.*

CLASS 2. **FUNGI.**

2. *Hypocreaceæ.*—Distinguished by rarely containing chlorophyll, saprophytes, parasites, either soft, fibrous, gelatinous, fleshy, leathery, horny, mycelium inconspicuous, often producing a dense homogeneous tissue; composed of 200 species. *Claviceps.*

SUB-KINGDOM II. **PTERIDOPHYT(ES)-A.**

CLASS 3. **FILICINÆ.**

3. *Polypodiaceæ.*—Distinguished by leaves being fronds, large, spores one kind, in cases (sporangia) on under surface or margin, circinate in vernation, stems usually prostrate, subterranean; composed of 70 genera, 3000 species. *Dryopteris.*

CLASS 4. **LYCOPODINÆ.**

4. *Lycopodiaceæ.*—Distinguished by yellow spores, low, usually moss-like evergreens, stems much branched, elongated, sporangia 1–3-celled, solitary in the axils of leaves, or on their upper surface; composed of 125 species. *Lycopodium.*

SUB-KINGDOM III. **SPERMATOPHYT(ES)-A.**

CLASS 5. **GYMNOSPERMÆ.**

5. *Pinaceæ* (*Coniferæ*).—Distinguished as resinous, evergreen trees, shrubs, flowers unisexual, no perianth, staminate—catkins, pistillate—

scaly aments, becoming cones, sepals naked (2), leaves needle-shaped; composed of 25 genera, 240 species. *Pinus, Juniperus.*

CLASS 6. **ANGIOSPERMÆ.**

SUB-CLASS 1. **Monocotyledones.**

6. *Graminaceæ.*—Distinguished by glumaceous flowers, paleæ 2 in each, stamens hypogynous, stems hollow, jointed, leaves 2-ranked; composed of 3500 species. *Zea, Saccharum, Hordeum.*

Liliaceæ.

7. *Melanthaceæ.*—Distinguished by ovary superior, capsules mostly septicidal, with rootstocks, rarely bulbs, perianth 6, stamens 6, seeds appendaged, leaves grass-like, polygamous or dicœcious; composed of 36 genera, 140 species. *Veratrum.*

8. *Liliaceæ.*—Distinguished by regular, symmetrical flowers, 6's, perianth non-glumaceous, petaloid, hypogynous, ovary 3-celled, anther 2-celled; composed of 125 genera, 1300 species. *Colchicum, Aloe, Urginea.*

9. *Smilaceæ.*—Distinguished by being mostly vines, woody, herbaceous, often prickly stems, leaves net-veined, flowers green, dicœcious, perianth 6, stamens 6, fruit globose berry, 1–6-seeded; composed of 3 genera, 200 species. *Smilax.*

10. *Zingiberaceæ.*—Distinguished by creeping rhizomes, calyx and corolla distinct, each 3, leaves stalked, sheathing, ovary inferior, stamens 6; composed of 30 genera, 280 species. *Zingiber, Elettaria.*

11. *Orchidaceæ.*—Distinguished by the 1-2 sessile anthers united to pistil, flowers irregular, reptile-shaped, perfect, perianth 6 in 2 rows, petaloid; composed of 410 genera, 5000 species. *Vanilla.*

SUB-CLASS 2. **Dicotyledones.**

SERIES I. **Choripetalæ.**

12. *Piperaceæ.*—Distinguished by jointed stems, ovary sincarpic, 1-celled, stigma sessile, 2, 3, 4, fruit fleshy, 1-celled, 1-seeded; composed of 8 genera, 1060 species. *Piper (Cubeba).*

13. *Salicaceæ.*—Distinguished by dicœcious flowers, both kinds in catkins, no perianth or only cup-like calyx, stamens 1–30, fruit capsule; composed of 2 genera, 200 species. *Salix, Populus.*

14. *Fagaceæ (Cupuliferæ).*—Distinguished by small flowers, monœcious, staminate—aments, pistillate subtended by involucre (united bracts) becoming a bur (cup), petals none, stamens 4–20, perianth 4–8-lobed; composed of 5 genera, 375 species. *Quercus.*

15. *Ulmaceæ.*—Distinguished by fugacious stipules, small flowers, monœcious, dicœcious, perfect or polygamous, perianth 3–9-parted, or sepals, petals none, stamens 3–9, ovary 1-celled, superior, samara, drupe or nut; composed of 13 genera, 140 species. *Ulmus.*

16. *Moraceæ.*—Distinguished by having milky juice, small flowers, monœcious, dicœcious, calyx 4–5-parted, petals none, stamens 4–5, ovary 1-celled, superior, fruit various; composed of 55 genera, 925 species. *Cannabis.*

17. *Santalaceæ.*—Distinguished by calyx 4–5 valvate-lobed, green or petaloid, stamens perigynous, sheathing disk, ovules suspended by funiculus; composed of 26 genera, 250 species. *Santalum.*

18. *Aristolochiaceæ.*—Distinguished by colored, irregular calyx, epigynous stamens, fruit capsule, many-seeded, leaves cordate; composed of 5 genera, 200 species. *Aristolochia.*

19. *Polygonaceæ.*—Distinguished by stems having many swollen joints, ochriate stipules above each, flowers perfect, calyx colored or greenish, ovary superior, 1-celled; composed of 30 genera, 800 species. *Rheum.*

20. *Chenopodiaceæ.*—Distinguished by succulency and flowers being ebracteated, minute, greenish, perfect or unisexual, ovary superior, 1-celled, fruit 1-seeded utricle; composed of 75 genera, 559 species. *Chenopodium.*

21.—*Myristicaceæ.*—Distinguished by leaves alternate, dotted, leathery, flowers diœcious, regular, calyx 3–4-cleft, filaments 3–12, united, ovary 1-celled, ovule 1, fruit succulent; composed of 5 genera, 100 species. *Myristica.*

22. *Ranunculaceæ.*—Distinguished by flowers being most complete, organs all distinct, no adhesions nor cohesion, often yellow; composed of 35 genera, 1050 species. *Hydrastis, Cimicifuga, Aconitum.*

23. *Berberidaceæ.*—Distinguished by the few stamens being in 2–3 whorls and anthers opening by two hinged valves (Podophyllum—longitudinal); composed of 20 genera, 105 species. *Podophyllum.*

24. *Menispermaceæ.*—Distinguished by flowers being diœcious, petals shorter than sepals, solitary seed moon- or kidney-shaped, woody climbers; composed of 55 genera, 150 species. *Jateorhiza.*

25. *Lauraceæ.*—Distinguished by polygamous flowers, calyx inferior, petaloid, anthers opened by 2–4 uplifted valves, ovary 1-celled, fruit drupe or berry; composed of 40 genera, 900 species. *Cinnamomum, Sassafras.*

26. *Papaveraceæ.*—Distinguished by the 2–3 fugacious sepals and minute embryo near the base of fleshy albumin; composed of 26 genera, 200 species. *Papaver.*

27. *Cruciferæ.*—Distinguished by pungent or acrid juice, cruciform flowers, tetradynamous stamens, and fruit a silique or silicle; composed of 185 genera, 1500 species. *Brassica.*

28. *Hamamelidaceæ.*—Distinguished by ovary being inferior; ovule solitary, pendent from cell apex, fruit capsule, 2-celled; composed of 15 genera, 35 species. *Liquidambar.*

Rosaceæ.

29. *Rosaceæ.*—Distinguished by prickles, warts on woody surface, flowers regular, stamens inserted on calyx tube, perigynous; composed of 65 genera, 1200 species. *Rosa.*

30. *Drupaceæ.*—Distinguished by bark exuding gum, bark and seeds containing hydrocyanic acid, calyx 5-lobed, free from ovary, petals (5), stamens (many) inserted on calyx, ovary 1-celled, 2-ovuled, drupe; composed of 6 genera, 110 species. *Prunus, Amygdalus.*

Leguminosæ.

31. *Mimosaceæ.*—Distinguished by ovary several-ovuled, fruit legumes, leaves 2–3-pinnate, flowers small, regular, calyx 3-6-lobed, corolla 3–6, stamens distinct or monadelphous, ovary 1-celled; composed of 30 genera, 1350 species. *Acacia.*

32. *Cæsalpiniaceæ.*—Distinguished by legumes, upper petal enclosed by lateral ones in the bud, leaves compound, stipulate, flowers perfect, monœcious, diœcious, polygamous, 5's; composed of 90 genera, 1000 species. *Copaiba, Cassia (Cathartocarpus).*

33. *Krameriaceæ.*—Distinguished by fruit spiny indehiscent, leaves simple, exstipulate, sepals 4–5, petals 5, smaller than sepals, stamens monadelphous, ovary 1–2-celled, ovules 2, fruit 1-seeded; composed of 1 genus, 15 species. *Krameria.*

34. *Papilionaceæ (Leguminosæ).*—Distinguished by legumes or loments, upper petal enclosing lateral ones in the bud, leaves compound, stipulate, calyx 4–5-toothed, petals somewhat united (banner, wings, keel), stamens usually 10, pistil 1, superior; composed of 310 genera, 5000 species. *Toluifera, Astragalus, Glycyrrhiza, Pterocarpus, Vouacapoua, Physostigma.*

35. *Linaceæ.*—Distinguished by flowers being regular, showy, stamens monadelphous at base, sepals imbricate, ovary 3–5-celled; composed of 4 genera, 150 species. *Linum.*

36. *Erythroxylaceæ.*—Distinguished from Linaceæ by the shrubby or arboreous habit, and by the drupaceous fruit, calyx 5-lobed, petals 5, stamens 10, hypogynous, ovary superior; composed of 3 genera, 60 species. *Erythroxylon.*

37. *Rutaceæ.*—Distinguished by leaves being exstipulate, dotted, petals imbricated, ovary sessile, surrounded at base by fleshy, glandular disk, or elevated on gynophore; composed of 110 genera, 880 species. *Barosma, Pilocarpus, Citrus.*

38. *Simarubaceæ.*—Distinguished from Rutaceæ by leaves being exstipulate, without glands or dots, disk conspicuous, ovary stalked; composed of 30 genera, 112 species. *Picrasma, Quassia.*

39. *Burseraceæ.*—Distinguished by secreting a resinous or gum-resinous juice, leaves compound, dotted, disk and stamens perigynous, ovary superior; composed of 26 genera, 150 species. *Commiphora.*

40. *Polygalaceæ.*—Distinguished by flowers being irregular, papilionaceous, stamens monadelphous, sepals 5, of which 2 inner are wing-like, petaloid; composed of 10 genera, 150 species. *Polygala.*

41. *Euphorbiaceæ.*—Distinguished by milky, acrid juice, flowers unisexual, apetalous, fruit tricoccous, 3–6-seeded capsule, radical superior; composed of 210 genera, 4000 species. *Croton, Ricinus.*

42. *Anacardiaceæ.*—Distinguished by milky, acrid, resinous juice, petals and stamens perigynous, disk hypogynous or wanting; composed of 50 genera, 400 species. *Rhus.*

43. *Rhamnaceæ.*—Distinguished by its spiny habit, perigynous stamens, concave petals, non-caducous, valvate sepals, fruit not a berry; composed of 45 genera, 575 species. *Rhamnus.*

44. *Malvaceæ.*—Distinguished by stamens monadelphous, anthers 1-celled, leaves often downy, palmate-divided; flowers showy, purple, yellow, white; composed of 40 genera, 800 species. *Althæa, Gossypium.*

45. *Sterculiaceæ.*—Distinguished by flowers being regular or irregular, petals sometimes absent, filaments usually monadelphous, anthers 2-celled; composed of 49 genera, 730 species. *Theobroma.*

46. *Theaceæ* (*Ternstræmiaceæ*).—Distinguished by sepals distinct, endosperm little or none, leaves alternate, flowers, large solitary, sepals 5, petals 5, hypogynous, ovary 2-several-celled, fruit 2–3-celled, woody capsule; composed of 16 genera, 160 species. *Thea.*

47. *Guttiferæ.*—Distinguished by yielding a resinous juice, stamens distinct, monadelphous or polyadelphous, flowers unisexual or polygamous, leaves coriaceous; composed of 24 genera, 340 species. *Garcinia.*

48. *Flacourtiaceæ.*—Distinguished by being chiefly tropical shrubs and trees with alternate dentate leaves, often transparent dots, axillary clusters of small diœcious flowers, straight embryo, edible fruit, economic products; composed of 79 genera, 300 species. *Taraktogenos.*

49. *Lythraceæ* (*Punicaceæ*).—Distinguished by calyx lobes being valvate, petals wrinkled, leaves exstipulate, stamens perigynous, inserted below the petals; composed of 21 genera, 350 species. *Punica.*

50. *Myrtaceæ.*—Distinguished by numerous stamens, leaves exstipulate, opposite, dotted, with marginal vein, ovary inferior; composed of 76 genera, 2700 species. *Eugenia, Melaleuca* (*Cajuputi*), *Eucalyptus.*

51. *Umbelliferæ.*—Distinguished by the 2-celled ovary forming a cremocarp, with vittæ (oil-tubes), flowers in umbels, stems hollow, ovary inferior, crowned with fleshy disk; composed of 170 genera, 1600 species. *Coriandrum, Carum, Pimpinella, Fœniculum, Ferula.*

SERIES II. **Gamopetalæ.**

52. *Ericaceæ.*—Distinguished by hypogynous corolla and stamens, anthers 2-celled, dehiscing by pores or slits, ovary 2–5-celled, leaves exstipulate, fruit capsule or berry; composed of 55 genera, 1050 species. *Gaultheria, Arctostaphylos.*

53. *Styraceæ.*—Distinguished by flowers of 5–10 stamens attached to 5-lobed corolla, anthers 2-celled, calyx coherent with ovary, superior or part inferior, fruit drupe; composed of 7 genera, 75 species. *Styrax.*

54. *Oleaceæ.*—Distinguished by 2 stamens, ovary superior, 2-celled, each with 2 ovules, corolla regular, 4–8-cleft, fruit capsule, berry, or drupe, seed albuminous, oily; composed of 21 genera, 500 species. *Fraxinus, Olea.*

55. *Loganiaceæ.*—Distinguished by opposite, entire, stipulate leaves, stamens epipetalous, styles divided as ovary cells number, fruit capsule, drupe, seeds winged; composed of 30 genera, 400 species. *Strychnos.*

56. *Gentianaceæ.*—Distinguished by being smooth herbs, leaves entire, glabrous, sessile, calyx and corolla persistent, ovary superior, fruit 2-celled capsule; composed of 65 genera, 600 species. *Gentiana.*

57. *Apocynaceæ.*—Distinguished by milky juice, from Asclepiadaceæ by stamens being free from style and stigma, anthers contain granular pollen, stigma hour-glass-shaped; composed of 130 genera, 1050 species. *Strophanthus.*

58. *Convolvulaceæ.*—Distinguished by milky juice, from Solanaceæ and Scrophulariaceæ by twining, trailing habit, alternate leaves, large solitary seeds, crumpled embryo, corolla 5's, plaited; composed of 40 genera, 900 species. *Exogonium, Ipomœa.*

59. *Hydrophyllaceæ.*—Distinguished by watery, insipid juice, flowers scorpioid, 5's, stamens borne on corolla base, styles 2, fruit capsule; composed of 17 genera, 160 species. *Eriodictyon.*

60. *Labiatæ.*—Distinguished by square stems, corolla bilabiate, stamens 4, didynamous, ovary 4-lobed, leaves aromatic, stigma bifid, fruit achenes; composed of 160 genera, 3000 species. *Rosmarinus, Lavandula, Thymus, Mentha.*

61. *Solanaceæ.*—Distinguished by colorless juice, flowers with plicate border, isomerous, ovules many, fruit capsule or berry, ovary superior; composed of 70 genera, 1600 species. *Capsicum, Atropa, Hyoscyamus, Datura.*

62. *Scrophulariaceæ.*—Distinguished by 2-celled ovary, numerous seeds, fleshy albumin, calyx 5-lobed, corolla irregular, 2-lipped, stamens 4, didynamous, ovary sessile, 2-celled, fruit capsule or berry; composed of 165 genera, 2500 species. *Digitalis.*

63. *Rubiaceæ.*—Distinguished by regular, epigynous corolla, valvate lobes, salver, rotate, or funnel-shaped, stamens on corolla-tube, epipetalous, ovary crowned with an epigynous disk, fruit capsule or fleshy nuts; composed of 355 genera, 5500 species. *Cinchona, Ourouparia, Coffea, Cephaëlis.*

64. *Valerianaceæ.*—Distinguished by corolla being epigynous, anthers free, seed exalbuminous, leaves exstipulate, ovary inferior, 3-celled, 2 empty; composed of 9 genera, 275 species. *Valeriana.*

65. *Cucurbitaceæ.*—Distinguished by stems being succulent, prostrate or climbing, with tendrils, flowers unisexual, leaves and stem scabrous, fruit pulpy; composed of 90 genera, 650 species. *Ecballium, Citrullus, Cucurbita.*

66. *Campanulaceæ.*—Distinguished by endosperm present, fleshy, usually milky juice, flowers perfect, calyx 5-lobed, gamopetalous, stamens 5, ovary 2–5-celled, fruit capsule or berry, seeds many; composed of 60 genera, 1500 species. *Lobelia.*

67. *Compositæ.*—Distinguished by compound flowers, watery or resinous (rarely milky) sap, calyx-tube adnate to ovary, corolla 5-lobed, stamens 5, borne on corolla, anthers syngenesious, ovary 5-celled, ovule 1, fruit achene; composed of 760 genera, 10,000 species. *Artemisia.*

PART I.

ORGANIC DRUGS FROM THE VEGETABLE KINGDOM.

Sub-kingdom I. **THALLOPHYT(ES)-A.**

Cellular cryptogams, composed of one or many cells, with no differentiation of root, stem, or leaves, the thallus being without true woody fibers and vessels.

Class I. **ALGÆ.**

1. GELIDIACEÆ. Red Seaweed Family.

Ge-li-di-a'se-e. L. *Gelidi-um* + aceæ, fr. L. *gelus, gelidus,* cold, frozen—*i. e.*, plants boiled down to a jelly—hardened by cooling. Composed of many marine algæ, red, purple, violet, few green or black—chlorophyll being masked by red pigment, phycoerythrine, which forms a carbohydrate differing from starch. Thallus has great variety of forms and structure, usually with apical growth and distinction of stem and root; fronds cartilaginous, terete or compressed, much branched; cystocarps immersed in frond and contain spores attached to axile placenta; universal; demulcent, nutritious, alterative, aperient.

Genus: **1. Gelidium.**

AGAR. AGAR, *U.S.P.*

Gelidium corneum (*Hudson*) *Lamouroux*, and other species, also closely related algæ. { The dried extracted mucilaginous substance, with not more than 1 p. c. foreign organic matter, yielding not more than 1 p. c. acid-insoluble ash and 16 p. c. moisture.

Habitat. Japan, China, Malaysia, Ceylon; Atlantic Ocean, United States.

Syn. Agar-agar, Jelly Plant, Corsican (Worm) Moss, Crow-silk, Japanese (Chinese, Bengal, Ceylon) Isinglass, Vegetable Gelatin, Gelosine; Fr. Mousse de Chine; Ger. Wurmmoss, Wurmtang.

Ge-lid'i-um. L. see etymology, above of Gelidiaceæ.

Cor'ne-um. L. fr. *corneus*, hard, horny—*i. e.*, the tough fronds.

A'gar-A'gar—*i. e.*, fr. Malay *agar-agar*, Eastern name of Ceylon Moss or Bengal Isinglass.

Plant.—Very similar to *Chondrus crispus* and *Gigartina mamillosa*, *Irish Moss*, but in reproduction the carpogonium gives rise to one or

GELIDIACEÆ

more elongated branched ooblastima filaments which fuse with one or more auxiliary cells, the sporangia being produced from the ooblastima filaments—not directly from the auxiliary cell (cells). AGAR occurs usually in bundles, 30–60 Cm. (1–2°) long, consisting of thin, translucent, membranous, agglutinated pieces, 4–10 Mm. ($\frac{1}{6}$-$\frac{2}{5}$′) broad, yellowish-brownish-white, tough (damp), brittle (dry), insoluble in water, slowly soluble in hot water; solution in hot water (1 in 100)—stiff jelly upon cooling; odor slight; taste mucilaginous. POWDER, pale buff—in chloral hydrate T. S., fragments transparent, granular, striated, angular, occasionally frustules of diatoms. *Tests:* 1.—With iodine T. S., some fragments—bluish-black, with some areas—bright red. 2.—Aqueous-solution (1 in 100), made by boiling, upon cooling, + tannic acid T. S.—no precipitate (abs. of gelatin), + iodine T. S.—not blue (abs. of starch). *Impurities:* Shells, incrusting Bryozoa, spicules, sand, gelatin, starch. *Solvent:* hot water. Dose, ʒj–2 (4–8 Gm.).

FIG. 1.—Agar; portion of sheet; granules.

Commercial. — Seaweeds, collected by hand and rakes, May-August, are spread upon beach to dry and bleach in the sun, then pounded by hand, or passed through a concrete mortar-and-pestle battery (to remove adhering shells, frustules, spicules, sand, etc.), then alternately washed and sun-dried for several days until thoroughly bleached and cleansed —a process sometimes hastened by bleaching chemicals. It is now boiled, 3–5 hours, with water (1 in 50) in an iron kettle (to extract the gelose in soluble form), filtered through (1) coarse cloths and (2) squeezed through linen bags in a press (to separate from insoluble matter), and the filtered jelly poured into wooden trays, 2° long, 1° wide, 3′ deep, to cool and solidify into hard jelly (Japanese "tokoroten"), which is cut by sharp knives into blocks, 1° long, 2′ square, and pressed through coarse wire grating that divides them into bundles of slender straws. In this condition the "tokoroten" is subjected to low temperature,—5– —15° C. (23–5° F.), until sticks are frozen solid (to allow water to crystallize out), and then melted (to permit substances soluble in cold water to drain off in solution), thereby leaving pure gelose. Repeated freezing, thawing, and drying in the sun (open air) yields a pure agar insoluble in cold water. Sticks, before thoroughly dry, may be put through a forcing machine

that flattens each fine strip into a transparent sheet, which, after drying in the sun, are tied into bundles, ½–3 pounds; it is also prepared in sheets, 8–12′ long, 1–1½′ wide, and in rectangular blocks, 8′ long, 1′ square. Our importation, 1920, was 240 tons, valued at $500,000, which suggests our using *G. cartilagin'eum* and *G. aman'sii*, California coast, that yield a dry gelatin 28–30 p. c., of which a 2 p. c. solution makes a hard, elastic jelly, the equal of agar, that remains hard at 58° C. (137° F.), and does not begin to liquefy until 76° C. (170° F.).

Fig. 2.—*Chondrus crispus: a*, narrow form, with fruit; *b*, broad form; *c*, small form.

Constituents.—Gelose (*gel*(atin)+*ose*), amorphous gelatin-like carbohydrate 60–70 p. c., moisture 23 p. c., mineral salts, ash 4 p. c.; gelose heated with strong nitric acid yields mucic and oxalic acids; dissolved in acidulated water with heat—does not gelatinize on cooling.

Properties and Uses.—Demulcent, nutrient, aperient, emulsifier. In the United States chiefly in hospitals and bacteriological laboratories as a base for culture media, being superior to any substitute as it remains solid (other jellies useless—melting under requisite conditions), with a smooth, firm surface at the higher temperature required for cultivating certain species of bacteria. In chronic constipation (instead of mineral oil), the action depends on its property of absorbing and holding water, along with it becoming a lubricant and mild mechanical

GELIDIACEÆ

stimulant, unaffected by digestive enzymes or intestinal bacteria; action not violent, as ordinary cathartics, and leaves no harmful after-effects, being best when stools unduly dry. In Japan and China long esteemed as a food in making jellies and candy, thickening soups, ice cream, fruits, meats, fish, etc. It is a valuable dressing for wounds, and its emulsion for photographic plates is superior to that of ordinary gelatin. May be taken in granular powder, or emulsionized with mineral or other oils, or mixed with cereal, bread, biscuit, chocolate agar, etc. It is a poor substitute for sodium stearate in suppositories, as it absorbs only 70 p. c. of glycerin, and melts at higher than body temperature. Native "Kanten" and "Funori," from related algæ, are used to impart gloss to textiles, silk, stiffening linen (starch), decorating china, plastering walls, sizing, glue, etc. Dose, ʒj–4 (4–15 Gm.).

Allied Plants:

1. *Chon'drus cris'pus* or *Gigarti'na mamillo'sa, Irish Moss, Carrageen, N. F.*—Gigartinaceæ. The dried, bleached plants, with not more than 2 p. c. of foreign organic matter; Atlantic Ocean, New England, Irish coast. Entire plants small, matted together, slender dichotomously branching stalk; segments flattened, emarginate, cleft at tips, 5–15 Cm. (2–6′) long, 1–10 Mm. ($\frac{1}{25}$–$\frac{2}{5}$′) broad, yellowish-white, transparent, somewhat cartilaginous, frequently coated with calcareous deposit which effervesces with hydrochloric acid; sporangia embedded (*C. crispus*) or on short stalks (*G. mamillosa*); odor slight, seaweed-like; taste mucilaginous, saline; solvent: water; contains mucilage (carrageenin—not precipitated by alcohol—gum, or by lead acetate—pectin, or blue with iodine—starch, only slightly adhesive) 55–90 p. c., minerals 14 p. c., albuminoids 9 p. c., water 18 p. c., ash 8–15 p. c. Demulcent, nutrient, dietetic; bronchitis, diarrhea, kidney and bladder affections—diet instead of tapioca, sago, barley. Plants green (fresh) or purplish (dry) are taken from the beach after storms, or are torn by boatmen with rakes from rocks, 3–6 M. (10–20°) under water, then washed in sea water and spread high on shore for drying and bleaching—a process frequently repeated several times. Dose, ʒj–2 (4–8 Gm.); 1. *Mucilago Chondri*, 3 p. c.—emulsifier; Decoction, 5 p. c. (water or milk, sweetened and flavored), ʒj–2 (30–60 cc.). *G. acicula'ris* and *G. pistilla'ta* have similar appearance and properties.

2. *Fu'cus vesiculo'sus, F. serra'tus, F. nodo'sus*, or *F. siliquo'sus, Fucus, Bladderwrack, N. F.*—The dried thallus with not more than 3 p. c. of foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; Atlantic Ocean: grows on muddy rocks and often floats to the shore. It is 1 M. (3°) long, or less, .5–4 Cm. ($\frac{1}{5}$–$1\frac{3}{5}$′) broad, dichotomously branched, brownish-black, whitish incrustation, flat, smooth, entire or serrate, with or without stout midrib, with or without oval air-vesicles, single or pairs, apex of thallus occasionally swollen, numerous conceptacles; odor strongly seaweed-like; taste saline, nauseous. Powder, reddish-brown—polygonal and elongated cells, pseudo-parenchyma with thick mucilaginous walls; solvents: water,

diluted alcohol; contains organic matter (mainly mucilage with little mannite (fucose), fats, etc., 62 p. c., volatile oil (trace), moisture 22 p. c., ash 2.5–20 p. c.—K, Na, chlorides, bromides, iodides, phosphates, sulphates. Alterative; obesity, enlarged glands, goiter. Dose, ʒss–2 (2–8 Gm.); 1. *Fluidextractum Fuci* (75 p. c. alcohol), dose, ʒss–2 (2–8 cc.); Decoction, 5 p. c., ʒj–2 (30–60 cc.); Extract (alcoholic), gr. 5–10 (.3–.6 Gm.)

FIG. 3.—*Gigartina mamillosa: a*, narrow form, with fruit; *b*, large form; *c*, small form.

FIG. 4.—*Fucus vesiculosus:* fruiting branch, natural size.

3. *Dulse* (*Halyme'nia* (*Fucus*) *palma'tus* and *H. ed'ulis*).—Atlantic and Mediterranean coasts; blood-red—when dry dark purple, fronds flat.

4. *Ceylon Moss.*—Indian Ocean. Mostly *Sphærococ'cus lichenoi'des*, 10 Cm. (4′) long, 1.5 Mm. ($\frac{1}{16}$′) thick, cylindrical, forked, filiform above; reddish—when dry whitish, brittle.

5. *Corsican Moss.*—Mediterranean. A mixture of 20–30 different Algæ species, mainly *Sphærococcus* (*Fucus*) genus; these are yellowish-brown.

HYPOCREACEÆ

Class 2. **FUNGI.**

2. HYPOCREACEÆ. Flesh-consuming Family.

Hy-poc-re-a′se-e. L. fr. Gr. ὑπο, under, through, by, + κρέας, flesh—*i. e.*, some of the species live upon meat (caterpillars and other insects). Exist mostly upon dead organic matter, sometimes upon living plants and insects; rarely with chlorophyll, mycelium inconspicuous, frequently producing a dense homogeneous tissue; ascocarps complex and either open from the first or at a later period; conidium formation occurs in many ways both from the mycelium and stoma; temperate climates; hemostatic, ecbolic, poisonous.

Genus: **1. Claviceps.**

ERGOTA. ERGOT, *U.S.P.*

Claviceps purpurea, (*Fries*) *Tulasne.* { The dried sclerotium, developed on rye plants with not more than 5 p. c. seeds, fruits, or other foreign organic matter.

Habitat. Eastern countries, Russia; cultivated in Spain, Germany, France.

Syn. Ergot of Rye, Spurred Rye, Cockspur Rye, Smut of Rye, Mother of Rye, Hornseed, Secale Clavatum, Mater Secalis, Clavus Secalinus; Fr. Ergot de Seigle, Seigle Ergoté (noir), Blé Cornu; Ger. Secale cornutum, Mutterkorn, Zapfen-, Hunger-korn.

Er′go-ta. L. fr. Fr. *ergot, argot,* a spur—*i. e.*, its spur shape.

Clav′i-ceps. L. *clava,* a club—*i. e.*, shape of the mycelium or sclerotium.

Pur-pu′re-a. L. *purpureus,* purple colored—*i. e.*, the purple claviceps—color of the sclerotium.

Scle-ro′ti-um. L. fr. Gr. σκληρός hard—*i. e.*, a hard body formed by certain fungi.

Plant.—Rye: culm 1.5–2 M. (5–6°) high; leaves .25–.5 M. (10–20′) long, upper surface rough; spike 10–15 Cm. (4–6′) long, 2-sided, 2-flowered spikelet, June; fruit July; seed (grain) oblong, grooved on upper side, hairy at summit, brownish. Sclerotium (ergot), cylindraceous, obscurely 3-angled, fusiform, obtuse, somewhat curved, 1–4.5 Cm. ($\frac{2}{5}$–$1\frac{4}{5}$′) long, 3–5 Mm. ($\frac{1}{8}$–$\frac{1}{5}$′) thick, purplish-black, longitudinally furrowed; fracture short, white, tinged with purple or gray; odor characteristic but free from mustiness or rancidity; taste oily, somewhat acrid, disagreeable. Powder, grayish-brown—purplish and whitish fragments of outer tissue and thin-walled cells. *Tests:* 1. Shake 1 Gm., for 5 minutes in a closed flask, with ether 20 cc. + 15 drops of 20 p. c. sulphuric acid, shake filtrate thoroughly with 15 drops of cold saturated sodium bicarbonate solution, the separated lower aqueous layer—red or violet (pres. of sclererythrin). 2. Hot water added to crushed or powdered—no rancid or ammoniacal odor.

Ergot that breaks with a sharp snap, devoid of pinkish fracture, hard, brittle between the teeth, odorless and tasteless, should be rejected. Should be dried at a low temperature, and as it deteriorates

with age should not be kept longer than one year. *Solvent:* diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Commercial.—Rye is to Russia what corn is to America, its bread approximating nearer that of wheat than any other grain. The origin of the sclerotium is the biennial thallophyte (fungus) *Claviceps purpurea*, parasitic during moist seasons on the ovary of grains, grasses, sedges—Carex, Cyperus species, etc. (that of rye alone being collected for medicine),—the development having three stages: 1, *mycelial*—when blooming a few ovaries in some grain heads become covered with sweet, yellow mucus, *honey-dew of rye*, whose disagreeable odor repels bees, but attracts ants, beetles, and flies—the once supposed cause of the diseased grain, but now known only to aid its dissemination and thereby the spreading of the disease; the filamentous cells (hyphæ), collectively forming the mycelium, spread over the lower portion of the ovary and cause decomposition of ovarian tissue, production of honey-dew (sugar), and innumerable reproductive bodies (conidia) imbedded therein; 2, *sclerotial*—when this conidial formation is at its height the mycelium ceases its superficial growth, presses into the ovary and begins to form a denser tissue at its base and central portion, and, growing upward, ruptures it and develops into a purplish-black, horn-like body, sclerotium (official ergot)—the dormant or resting form of the fungus; 3, *thalloidic*—when in the following spring ergot sprouts in many heads (stromata), consuming its fixed oil and other constituents, and becoming shriveled and worthless; have formed upon the head's surface spherical-topped excrescences, size of small pin's head, containing the orifices of flask-shaped cavities (conceptacles, perithecia) from whose base many cells (spore-sacs, asci) arise, each containing 8 filiform spores formed synchronous with rye flowers, so that the two (spores, flowers) acting together develop again the sphacelia (sclerotium), hence the necessity of using fresh ergot in medicine, at the end of the second stage, prior to the beginning of the third.

Fig. 5.—Ergotized rye.

Ergot must be dried (too much causing injury, too little moldiness) and stored (very dry, in well-stoppered bottles) with great care, as the fixed oil soon inclines to become rancid, and a mite ofttimes will

attack it, in either case rendering the product worthless. This deterioration may be prevented largely by either (1) deoleation—extracting fixed oil with ether or petroleum benzin, drying, (2) adding occasionally a few drops of chloroform to the closed container, (3) suspending in the container a tube of potassium sulphate saturated with formaldehyde, (4) keeping over unslaked lime, (5) coating with ethereal solution of Tolu or (6) mixing powdered drug with benzoin (5 p. c.); in any event only the preservation of the sclerotium (entire) can be relied upon. There are three varieties: 1, *Spanish*, largest, finest-looking, highest-priced, bluest; 2, *Russian*, reddish-purple, considered most active; 3, *German*, reddish-purple.

FIG. 6.—Ergot, with fruit heads.

FIG. 7.—Longitudinal section of fruiting head, showing conceptacles.

FIG. 8.—Ergota.

CONSTITUENTS.—Alkaloids .38–.6 p. c.: Ergotoxine, Parahydroxyphenylethylamine (Tyramine), Histamine, Isoamylamine, Ergamine, Enzymes (2). Fixed oil 30 p. c., sclererythrin (coloring matter), scleromucin (mucilage); ergotininic acid, clavine, ergotinine, all three more or less inactive; ash 5 p. c. Such names as cornutine, sphacelotoxine, ergotinic acid, etc., only represent indefinite substances and should be abandoned.

Ergotoxine.—This, the essential active constituent, produces the true therapeutic effect of ergot (bluing of the cock's comb, contracting uterus, etc.): it is amorphous, but forms crystalline salts, phosphate, sulphate, tartrate, suitable for hypodermic injection; its presence in the other constituents often contribute its marked properties; action may largely be due to the amino group, in which fresh ergot is richest —just before rye is ripe.

Para-hydroxyphenylethylamine (Tyramine).—This and other amines (ammonia from putrefaction) may stimulate the uterine muscular wall (nerve-endings) and raise blood-pressure, while histamine stimulates uterine action, but lowers decidedly blood-pressure, both serve chiefly as synergists to the action of ergotoxine.

Enzymes.—These (one diastasic, the other hydrolyzing fats) rapidly deteriorate and reduce the physiological activity of ergot that has

been dried slowly and imperfectly, forming a rancid, fatty odor (trimethylamine); both enzymes lose hydrolytic power by prolonged keeping or complete drying of the ergot, hence the necessity of proper care in this process.

Fixed Oil.—This is a dark brown liquid containing oleic acid 68 p. c., oxyoleic acid 22 p. c., palmitic acid 5 p. c., sp. gr. 0.925, and when removed by ether or petroleum benzin the ergot retains full alkaloidal strength which remains unimpaired for years if kept with care.

PREPARATIONS.—1. *Fluidextractum Ergotæ*, Fluidextract of Ergot. (Syn., Fldext. Ergot., Fluid Extract of Ergot; Br. Extractum Ergotæ Liquidum; Fr. Extrait fluide d'Ergot de Seigle; Ger. Extractum Secalis cornuti fluidum, Mutterkornfluidextrakt.)

Manufacture: Percolate 100 Gm. with sufficient purified petroleum benzin to remove fixed oil, discard benzin percolate; remove ergot from percolator, expose it to air, when dry moisten with sufficient 1st menstruum (diluted alcohol 98 cc. + hydrochloric acid 2) to keep damp while macerating 6 hours in a tightly covered container, pack in percolator, add remainder of 1st menstruum, then 2d menstruum (diluted alcohol) to saturate and cover; macerate 48 hours, percolate with 2d menstruum until exhausted; reserve first 85 cc., reclaim alcohol from remainder, concentrate residue at 60° C. (140° F.) to soft extract, which dissolve in the reserved portion, mix thoroughly, add 2d menstruum q. s. 100 cc. When administered by intramuscular injections to single-comb, white Leghorn cocks, in doses of .5 cc. for each Kg. of body weight of cock—the comb becomes darkened in degree as by same dose of standard fluidextract; contains alcohol 37–42 p. c. Dose, ♏xv–60 (1–4 cc.).

2. *Extractum Ergotæ Aquosum, Ergotine, N. F.*—Ergot 200 Gm., chloroform water q. s. to exhaust, evaporate to 100 cc., cool, add alcohol 100, evaporate to pilular consistence. Dose, gr. 1–5 (.06–.3 Gm.) + water, hypodermically.

Unoff. Preps.: Extract (menstruum same as official fluidextract), gr. 2–10 (.13–.6 Gm.); Infusion (Br.), 5 p. c., ℥ j–2 (30–60 cc.; Tincture, 15 p. c.; Wine, 20 p. c.; *Ergotin* (Bonjean's—aqueous extract deprived of scleromucin by precipitating with alcohol, filtering, evaporating), dose, hypodermically, gr. ¼–5 (0.16–.3 Gm.).

PROPERTIES.—Emmenagogue, ecbolic, parturient, astringent, hemostatic, excitomotor, poisonous. Value depends upon (1) bluing (gangrene) of the cock's comb, (2) contracting the uterus, (3) raising the blood-pressure: contracts all unstriped (involuntary) muscle, especially uterus and intestine, expelling their contents. Depresses heart muscle, hence slows pulse, contracts arterioles (hemostatic), thus increasing arterial pressure; diminishes sweat, saliva, milk, urine. In large doses gastro-intestinal irritant, causes nausea, vomiting, colic, thirst, purging, convulsions, "acute ergotism," or by many small doses may have "chronic ergotism;" this last may be in two forms: 1. Convulsive, causing tetanoid spasms of the flexors, respiratory

muscles, death by asphyxia. 2. Gangrenous, causing cold, numb limbs, loss of sensibility, gangrene of lower extremities, buttocks, etc., epileptic convulsions, coma, death.

USES.—In labor to increase the power and duration of uterine contractions—tetanic spasm; these are continuous while natural labor-pains are intermittent, hence ergot is dangerous in thoughtless hands. Should never be used until after head is born, when it simply promotes firm uterine contraction; it is still wiser to withhold it until after birth, to prevent postpartum hemorrhage and aid uterine contraction (fluid-extract ℥j (4 cc.) by mouth, or better, hypodermically. A small dose (one-third) often controls uterine inertia in labor, where nerve-stimulants (coffee, strychnine, etc.) fail; this does not bring on constant tetanic contraction, but simply the "to-and-fro" movements. Effect lasts half an hour, being felt in 15 minutes, and should be repeated every 15 minutes until action manifest. Used also in epistaxis, night-sweats, dysentery (bloody), diarrhea (serous), hemorrhoids (bleeding), chronic metritis, dysmenorrhea, menorrhagia, fibroids, polypi, plethoric amenorrhea, atonic spermatorrhea, atonic arterial hemorrhage (males and females), spinal congestions, splenic enlargement, lax sphincters, incontinence of urine, aneurisms, diabetes. Externally to hemorrhoids.

For hypodermic injection—employ "Ergot Aseptic," or "Ergone," or solid extract deprived of alcohol and dissolved in water—introduce near seat of trouble; results here much better than by mouth; should have bladder and bowels freely open. The ergot formed on grasses is often sufficient to cause grazing animals to abort, and flour made of grain containing much of it will also sometimes act medicinally.

Poisoning: Have gastric disturbance, vomiting, diarrhea, thirst, burning pain in feet, tingling in fingers, cramps in extremities, dilated pupils, cold surface, dizziness, small and feeble pulse, convulsions. Evacuate stomach (pump, emetics, purgatives), use tannic acid, stimulants, amyl nitrite (inhalation), strychnine, digitalis, friction, hot baths.

Incompatibles: Cardiac and motor depressants (aconite, veratrum, lobelia, etc.), caustic alkalies, metallic salts.

Synergists: Digitalis, belladonna (circulation), strychnine (nerves), ustilago, cotton root bark, hydrastine, emmenagogues.

Allied Plants:

1. *Saccharomy'ces* (*Tor'ula*) *cerevis'iæ*, *Cerevisiæ Fermentum Compressum*, *Compressed Yeast*, *N.F.*—Saccharomycetaceæ. The moist living cells of this or other species, combined with a starchy or absorbent base; must only be used when fresh and free from mildew and musty or foul odors. Yeast plant is unicellular, multiplies by budding, being produced during alcoholic fermentation of malt liquors or saccharine fluids. There are two varieties: 1, Top or surface yeast—most active, semi-fluid frothy mass, odorous, cellular, fermenting in 3–4 days, at 15–20° C. (59–60° F.); 2, Bottom or sediment yeast—much slower,

at 6–8° C. (43–46° F.), reproducing by isolated spores; when liquid becomes hard, dry (yeast cake), vitality retained for a long time. It is in white, yellowish, soft, easily broken masses, characteristic, slightly sour odor, faintly acid reaction; under microscope—numerous oïdium and mycoderma cells, starch grains; contains enzymes—zymase, invertase, diastase, maltase; insoluble in alcohol, water, ceases to vegetate below 5° C. (41° F.); will stand —60° C. (—70° F.) without being killed. Tonic, stimulant, laxative, antiseptic poultice; typhoid, diabetes, diarrhea, scurvy, diphtheria, sores, bruises. Dose, ʒss–1 (15–30 Gm.); 1. *Lac Fermentatum, Kumyss,* .3 p. c., dose, ʒviij (240 cc.).

2. *Roccel'la* (*tincto'ria*) and *Lecano'ra* (*tarta'rea*) species, or other lichens; *Persio, Cudbear, N.F.*—Parmeliaceæ. A purplish-red powder prepared from these lichens, yielding 12 p. c. ash; Holland. Made by heating lichens for a week with diluted ammonia, drying, powdering; alcoholic preparations deep red—lighter with acids, purplish-red with alkalies. To color preparations; 1, *Tinctura Persionis,* 10 p. c. (75 p. c. alcohol): Prep.: 1. *Syr. Phos. Co.,* $\frac{1}{6}$ p. c. 2. *Tinctura Persionis Composita,* 1.5 p. c. + caromel 10 p. c. (33 p. c. alcohol): Preps.: 1. *Elix. Ammon. Valer.,* $\frac{1}{6}$ p. c.; 2. *Elix. Cinchon. Alk.,* 5 p. c.; 3. *Syr. Bromidor.,* $\frac{1}{6}$ p. c.; 3. *Elixir Aromaticum Rubrum,* $\frac{1}{5}$ p. c.; 4. *Elixir Bromidorum Trium,* $\frac{1}{5}$ p. c.; 5. *Elixir Pepsini Compositum,* $\frac{1}{10}$ p. c.; 6. *Liquor Aromaticus Alkalinus,* $\frac{1}{5}$ p. c.; 7. *Syrupus Pini Albæ Compositus,* $\frac{1}{10}$ p. c. *Lacmus, Litmus,* a blue pigment from these lichens by mixing (powder) with potassium carbonate, diluted ammonia water, exposing to air 6 weeks for fermentation, when it gradually turns red, purple, blue, and at the different stages is mixed with chalk and formed into cakes. *Orchil* is prepared likewise adding diluted ammonia, sulphuric acid and sodium chloride—deep purple.

3. *Cetra'ria islan'dica, Iceland Moss.*—The dried plant, U.S.P. 1820–1890; N. hemisphere. Thallus 5–10 Cm. (2–4′) long, foliaceous, fringed, and channeled lobes, brownish above, whitish beneath, apothecia (fruits) brown, flattish, brittle, inodorous; taste mucilaginous, bitter; contains cetraric acid (bitter) 2–3 p. c., which removed leaves digestible food product containing proteins 2.8 p. c., fat .4 p. c., cellulose 4–6 p. c., lichenin (starch) 79.2 p. c., related substance, water 6 p. c., ash 6.99 p. c. Demulcent (starch), tonic (cetraric acid), nutritive; chronic catarrhs, pulmonary affections (bronchitis, consumption), chronic diarrhea, dysentery; bread, instead of acacia. Dose, ʒss–1 (2–4 Gm.); decoction, .5 p. c., ʒj–4 (30–120 cc.).

4. *Polyp'orus* (*Bole'tus*) *officina'lis, Agaricus; Agaric, White* (*Larch*) *Agaric, N.F.*—Polyporaceæ. The dried fruit body, deprived of outer rind, with 5 p. c. foreign organic matter, yielding to boiling alcohol 50 p. c. non-volatile resinous extract; C. and S. Europe—growing on *Pinus, Larix, Picea* species. In light, fibrous, spongy, irregular pieces, grayish, brownish; internally yellowish, resinous; fracture tough; friable, difficult to powder; odor faint; taste sweetish, acrid, bitter. Powder, yellowish-brown—numerous narrow mycelial threads, few calcium oxalate crystals; solvent: diluted alcohol; contains agaracin. Antihydrotic;

sweating from coal-tar products and salicylates—acts upon nerve filaments in the sweat-glands. Dose, gr. 5–10 (.3–.6 Gm.); 1. *Pilulæ Antiperiodicæ*, $\frac{1}{8}$ gr.; 2. *Tinctura Antiperiodica*, $\frac{1}{5}$ p. c., +; *Agaracin*, gr. 1–2 (.06–.12 Gm.).

5. *P. (Bole'tus) fomenta'rius, Agaric of the Oak (Touch Wood).*—The fungus, U.S.P. 1830; Europe, on *Quercus* and *Fagus* species. It is formed by an additional layer of fibers each year; is collected Aug.-Sept., and resembles the horse's hoof, being 15–25 Cm. (6–10′) wide. When young is soft, velvety, but becomes hard and ligneous; when deprived of outside ligneous portion, brownish above and yellowish-white beneath, porous, fibrous, tough, inodorous, tasteless; when for use is deprived of harder rind, sliced, boiled in lye, washed, beaten, until soft and pliable, then absorbs twice its weight of water; contains extractive, resin, nitrogenous matter, KCl, $CaSO_4$; the ash—Fe, Ca,

FIG. 9.—*Cetraria islandica: ap*, apothecium.

Mg, phosphate. Used locally with pressure to arrest hemorrhage. Agaric steeped in nitre solution yields spunk or tinder.

6. *Agar'icus musca'rius (Amani'ta musca'ria), Fly Fungus (Agaric).*—N. Europe, Russia. This mushroom grows in the autumn mainly, under pine trees; stalk is white, tuberous at base, 7.5–15 Cm. (3–6′) high, 1.8 Cm. ($\frac{3}{4}$′) thick. Cup (pileus) 10–15 Cm. (4–6′) broad, orange-red; contains chiefly *muscarine* (muscarina), $C_5H_{15}O_3N$, a colorless, odorless, crystalline, deliquescent alkaloid, yielding deliquescent salts (nitrate, sulphate); all usually occur as brown, syrupy liquids, soluble in water, alcohol; resembles Calabar bean in action; antihydrotic, antispasmodic, myotic. Reduces force and frequency of pulse, contracts muscles of intestines and bladder, increases abdominal secretions, causes dyspnea, paralysis, death. Given for intestinal torpor, duodenal catarrh, diabetes, antidote to atropine, to replace physostigmine. Dose (muscarine), gr. $\frac{1}{30}$–$\frac{1}{15}$ (.002–.004 Gm.).

7. *Ustila'go May'dis, Corn Smut.*—The fungous growth upon *Zea Mays*, U.S.P. 1880· United States, etc. The fungus is abundant upon stem, grains, and tassel; in irregular, globose masses 10–15 Cm. (4–6′) broad, consisting of a blackish, gelatinous membrane enclosing many blackish, globular, nodular spores; odor and taste disagreeable. Should be kept dry and not longer than one year; contains fixed oil 2.5 p. c., sclerotic acid, crystalline principle (ustilagine) and alkaloid (secaline), volatile base, sugar, mucilage, ash 5 p. c. Emmenagogue, parturient, increases uterine pains during labor, like ergot. Dose, gr. 15–30 (1–2 Gm.).

Sub-kingdom II. **PTERIDOPHYT(ES)-A.**

Vascular cryptogams (ferns), mostly terrestrial; stems, roots, leaves, woody fibers, and vessels well developed, spores go into flat or irregular prothallia bearing antheridia and archegonia.

Class 3. **FILICINÆ.**

3. POLYPODIACEÆ. Fern Family.

Pol-i-po-di-a′se-e. L. *Polypodi-um* + aceæ, fr. Gr. πολύς, many, + ποῦς, ποδός, foot—many feet, rays—*i. e.*, from the branched rootstocks of some species. Include nine-tenths of our ferns, being the typical family. Herbaceous with a permanent stem, which is usually prostrate or subterranean. Fronds large, simple, pinnate, pinnatifid or decompound, coiled in vernation; numerous sporangia, on the underside or margins, in clusters (sori). Sori with or without membranaceous covering (indusium), prothallium green; universal, bitter, astringent, anthelmintic, mucilage, tonic.

Genus: **1. Dryopteris.**

ASPIDIUM. ASPIDIUM. *U.S.P.*

Dryopteris Filix-mas, (*Linné*) *Schott.* { The rhizome and stipes, yielding not less than 6.5 p. c. oleoresin, nor more than 3 p. c. acid-insoluble ash.

Habitat. N. America, N. Asia, Europe, N. Africa. (Canada, westward to Rocky Mountains, Mexico, S. America, Andes, Himalaya Mountains, Polynesian Islands.).

Syn. Male Fern, Male Shield Fern, Bear's Paw Root, Sweet Brake, Knotty Brake, Shield Root; Br. Filix Mas, Radix Filicis maris; Fr. Fougère mâle; Ger. Rhizoma Filicis, Farnwurzel, Wurmfarn, Waldfarn, Johanniswurzel.

Dry-op′te-ris. L. fr. Gr. *'δρυοπτερίς* – δρυός, of the oak, growing among trees, in thickets, + πτέρις, a feather, wing or fern—*i. e.*, their favored place of growth.

Fil′ix-mas′. L. *filix*, a fern, fr. Gr. πτέρις, a fern, frond, etc., + *mas*, male—*i. e.*, referring to its asexual fructification.

As-pid′i-um. L. fr. Gr. ασπίδιον, a little shield—*i. e.*, shape of the indusium.

Plant.—Tall, handsome, perennial fern; frond .3–1 M. (1–3°) high or long, bipinnate, pinnæ lanceolate, circular fruit dots situated on the

POLYPODIACEÆ

veins, near the midrib, covered by a heart-shaped indusium. RHIZOME, horizontal, 15–30 Cm. (6–12′) long, 5–7.5 Cm. (2–3′) thick, covered with stipe-bases, "fingers," which remain green several years and often constitute the greater bulk of the official drug; when peeled (deprived of stipes, roots) the rhizome itself is 7.5–15 Cm. (3–6′) long, 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}$′) thick, cylindraceous, nearly straight, or curved, tapering toward one end, usually split longitudinally, roughly scarred with remains of the stipe bases, or bearing several coarse longitudinal ridges and grooves; stipes nearly cylindrical but tapering toward one end, nearly straight or somewhat curved, 3–5 Cm. ($1\frac{1}{5}$–2′) long, 8 Mm. ($\frac{1}{3}$′) thick; brownish-black, if peeled—light brown; fracture short, pale green (inner half), spongy, exhibiting an interrupted circle of 6–12 small vascular bundles (steles); odor slight; taste sweetish, astringent, bitter, acrid. POWDER, greenish, brownish — must be prepared freshly. *Solvents:* alcohol; acetone; ether—extracting filicic acid, filicin, volatile oil, resin, chlorophyll, fixed oil, all occurring in the official oleoresin. Dose, ℥ss–2 (2–8 Gm.).

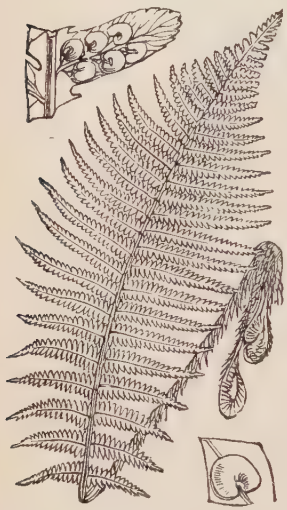


FIG. 10.—*Dryopteris Filix-mas.*

ADULTERATIONS.—Rhizomes of many indigenous ferns (chiefly *Osmunda* species) resembling the official, although such are thinner, free from chaff, and have stipes rarely closely imbricate, but when peeled and mixed practically defy detection; composition and properties are less subject to change in the unpeeled, while adulterations are recognized more easily; carelessness often renders the drug unreliable.

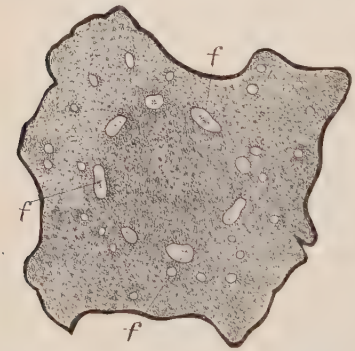


FIG. 11.—Filix-mas; transverse section magnified 3 diam.; *f*, fibro-vascular bundles.

FIG. 12.—Filix-mas; surface of peeled rhizome.

Commercial.—The "uncomminuted rhizome" covered with stipes (fingers) should be collected when strongest, autumn, freed from roots

and dead portions of rhizome and stipes (only such parts being retained as have green fracture), dried at 70° C. (120° F.), and quickly made into preparations, as it deteriorates rapidly, usually becoming inert in 1–2 years; soil and climate have greater influence upon amount of filicic acid than time of collection, etc.; the richest yield being from plants growing on strata of volcanic origin.

CONSTITUENTS.—Filicic acid 5–10 p. c., Filicin 19 31 p. c. (rohfilicin), fixed oil 6–7 p. c., filitannic acid 10 p. c., filix red, chlorophyll, volatile oil, 2 resins, ash 3 p. c. Böhm isolates aspidin (2–3 p. c.), albaspidin, aspidimin, aspidinol, and flavaspidic acid, and claims virtue to be chiefly in aspidin and filicic acid combined; Kraft and Jaquet believe the virtue to reside in filmaron. Dose, gr. 7–10 (.5–.6 Gm.).

Filicic (Filicinic) Acid, $C_{35}H_{42}O_{13}$.—Most active constituent, white, amorphous or crystalline, tasteless, more soluble than its anhydride, poisonous. Dose, gr. 10–20 (.6–1.3 Gm.).

Filicin (Filicic Anhydride), $C_{35}H_{40}O_{12}$.—Yellowish-white, non-poisonous, inactive, crystalline, soluble in most solvents except aqueous; yields with fusing potassium hydroxide butyric acid and phloroglucin.

PREPARATIONS.—1. *Oleoresina Aspidii.* Oleoresin of Aspidium. (Syn., Oleores. Aspid., Oleoresin of Male Fern, Oil of Fern; Br. Extractum Filicis Liquidum, Oleum Filicis Maris; Fr. Extrait (oléo résineux) de Fougère mâle; Ger. Extractum Filicis, Farnextrakt, Wurmfarnextrakt, Wurmfarnöl.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until exhausted, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place; yield 10–15 p. c. (acetone 18 p. c.). It is a dark green, thick liquid containing filicic acid 5–10 p. c., some of which deposits in granular crystals on standing, and must be mixed thoroughly with the liquid portion before dispensing. Should be preserved in well-stoppered bottles. Dose, ʒss–1 (2–4 cc.); more than ʒiss (6 cc.) is dangerous, while death has occurred from ʒvj (24 cc.).

Unoff. Preps.: Extract, gr. 15–30 (1–2 Gm.). *Fluidextract,* ʒj–2 (4–8 cc.).

PROPERTIES.—Tænifuge, tonic, astringent, poisonous.

USES.—This was known to the ancients as a vermifuge, being mentioned by Dioscorides, Galen, Pliny, Theophrastus, etc. In 1775 the King of France bought and made public this secret tapeworm remedy from the Swiss surgeon Nouffer's widow. It is next to pelletierine in reliability, and valuable in uncinariasis. In giving it for tapeworm the patient should fast the previous day, being nourished only by a little bread and milk; at night take ʒj (30 cc.) of castor oil, to expel nidus, and on the following morning a full dose of oleoresin, still fasting, and 2 hours later a full dose of Epsom salt; a full dose of calomel, jalap, gamboge, or saline enema may also clear away the dead worm.

Poisoning: Excessive doses may produce gastro-enteritis, abdominal pain, muscular relaxation, vomiting, purging, somnolence, albuminuria, glycosuria, paralysis, temporary blindness, convulsions, collapse, coma, death. Strong coffee, tea, tannin, empty stomach if vomiting has not been free (zinc sulphate, mustard, etc.), cardiac and respiratory stimulants—brandy, whisky, aromatic spirit of ammonia, strychnine, atropine, digitalis, morphine, artificial heat—avoid castor oil.

Allied Plants:

1. *Dryopteris margina'lis.*—Canada, United States, Rhizome, U.S.P. 1880–1910, similar to that of *D. Filix-mas*, except it has 6 steles instead of 10–20, and the round fruit dots are nearer the margin than the midrib. *D. rig'ida* (*Aspidium rig'idum*); S. Europe, California. Rhizome longer, thinner, with 6 vascular bundles. *D. athaman'tica* (*A. athaman'ticum*); S. Africa. Rhizome thicker, firmer than official, inside brownish, with black resin dots, broader vascular bundles.

2. *Polypo'dium vulga're, Common Polypody, Adian'tum peda'tum, Maiden hair,* and *Osmun'da rega'lis, Flowering Fern.*—All used for chronic catarrh, asthma, pectoral demulcent, tonic.

Class 4. LYCOPODINÆ.

4. LYCOPODIACEÆ. Club-Moss Family.

Li-ko-po-di-a'se-e. L. *Lycopodi-um* + aceæ, fr. Gr. λύκος, a wolf, + πούς, ποδός, a foot *i. e.*, from appearance of the shoots to a wolf's foot. Herbs resembling mosses. Distinguished by creeping stems, corms; leaves small, sessile, 4–16 ranks; sporangia in axis of leaves or scales, 1–3-celled, often reniform, 2-valved, containing many yellow spores, of one kind only, marked at summit with 3 radiating lines; prothallia subterranean, with or without chlorophyll; monœcious; universal; emetic, purgative, aphrodisiac, acrid principle poisonous, some spores inflammable.

LYCOPODIUM. LYCOPODIUM, *U.S.P.*

Lycopodium clavatum, *Linné.* } The spores.

Habitat. Europe, Asia, N. America, in dry woods.

Syn. Lycopod., Club Moss, Clubfoot Moss, Running Moss, Snake (Staghorn) Moss, Ground (Running) Pine, Wolf's Claw, Fox Tail; Vegetable Sulphur (Brimstone), Semen Lycopodii; Fr. Lycopode, Soufre végétal, Pied de Loup; Ger. Bärlappsporen, Hexenmehl, Streupulver, Blitzpulvre.

Ly-co-po'di-um. L. see etymology, above, of Lycopodiaceæ.

Cla-va'tum. L. *clavatus*, club-like—*i. e.*, alluding to club-like appearance of the fertile spikes.

Plant.—Low creeping perennial; stem .6–3 M. (2–10°) long, slender, tough, flexible, woody; branches ascending, leafy, the fertile terminated

by a slender peduncle 10–15 Cm. (4–6′) long, with 1–2 linear, cylindrical spikes—thecæ, cones, capsules, 2.5–5 Cm. (1–2′). long; leaves linear, awl-shaped, 6 Mm. ($\frac{1}{4}$′) long, dense, light green, tipped, as are also the numerous bracts, on the flowering spikes with a fine bristle; in axils of bracts have the kidney-shaped sporangia containing the spores. SPORES, a light yellow, very mobile powder, odorless, tasteless; spores shaped like 3-sided pyramid with convex base, .025–.04 Mm. ($\frac{1}{1000}$–$\frac{1}{625}$′) broad; outer surface reticulate — reticulations polygonal and formed by straight-sided delicate ridges, which form a delicate fringe at edges of spore; viewed with the rounded surface of spore on the under side, a distinct triangular marking is seen, formed by edges of flat surfaces of the spore. *Tests:* 1. Not wetted by water—floats upon it; when boiled with water—sinks, when thrown into a flame—burns with a quick flash. 2. Shows very few, if any, pollen grains, .04–.07 Mm. ($\frac{1}{625}$–$\frac{1}{360}$′) broad, and consisting of a central convex, generative cell separating two spherical cells or wings containing air (abs. of pine pollen). 3. Boiled with water and cooled, + iodine T. S.—no bluish color (abs. of starch), or reddish color (abs. of dextrin).

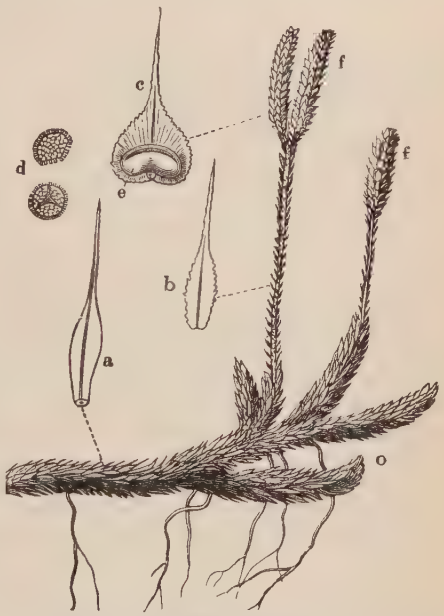


FIG. 13.—*Lycopodium clavatum: o*, a fragment of stem with spore-bearing spikes, *f*, *f*; *a*, leaf of stem; *b*, leaf of fertile branch; *c*, cone scale (bract) showing sporangium *e*; *d*, spores.

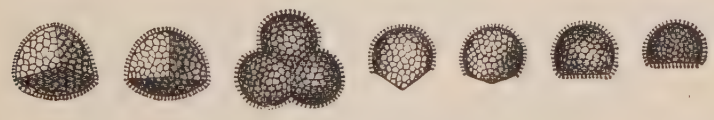


FIG. 14.—Lycopodium.

ADULTERATIONS.—Pine pollen (coarser, less mobile, mixes more easily with water), starch, flour (sometimes 25 p. c., sinks in carbon disulphide), dextrin (soluble in water, when concentrated—precipitated by alcohol), sulphur (dissolves in carbon disulphide, remaining upon evaporation), rosin (treat with alcohol, evaporate), turmeric (reddish-brown with alkalies), talc, gypsum, ferruginous earth, sand

(increasing ash beyond 3–5 p. c., and quickly subsiding when shaken with carbon disulphide, chloroform, or water).

Commercial.—Collected, July–August, in Scandinavia, Baltic lands, Northeastern Poland, Russia, etc., chiefly from *L. clavatum*, rarely *L. complana'tum* (spikes (cones) or sporangia, and spores of each very similar), by villagers in wooded areas, who sell their product to local agents, who, after drying it 1–2 weeks, avoiding artificial heat, shake the spores out through ordinary flour sieves, when it contains 5–10 p. c. of impurities (leaves, scaly fragments, sand, wheat and rye flour, etc.). Spikes when ripe yield pure spores 23 p. c., when green 10–15 p. c.

FIG. 15.—Pollen of pine.

CONSTITUENTS.—Fixed oil 47–49 p. c., cane-sugar (sucrose) 2 p. c., volatile base (methylamine), ash 3–5 p. c. (sand + 1 p. c. P_2O_5). The substance of the cell-wall is called pollenin; when treated with potassium hydroxide gives yellow color, becoming blue upon the addition of sulphuric acid and iodine. The oil, similar to expressed oil of almonds, contains palmitic, stearic, myristic, and oleic acids—the latter 80 p. c. being slightly abnormal.

PROPERTIES.—Once considered diuretic, antispasmodic for rheumatism, epilepsy, pulmonary and renal disorders, dysentery.

USES.—Externally to protect tender and raw surfaces, erysipelas, eczema, herpes, ulcers, chafing in infants; in pharmacy as a basis for insufflations, also to prevent adhering of pills, suppositories, etc. Popular "homeopathic medicine" (1 to 100 lactose triturated till oil liberated); internally gives excited circulation, urinary irritation, often cures dyspepsia, flatulence, constipation, aneurism, diphtheria, mucous membrane affections of lungs and bronchi.

SUB-KINGDOM III. SPERMATOPHYT(ES)-A (PHANEROGAMIA).

Seed-producing plants, each containing a complete embryo, and includes the greatest number (120,000), as well as the highest forms of plants.

CLASS 5. GYMNOSPERMÆ (Seeds naked, not enclosed in an ovary).

5. PINACEÆ (CONIFERÆ). Pine Family, Conifers.

Pi-na'se-e. L. *Pin-us* + aceæ, fr. Celtic *pin*, *pyn*, a mountain, rock —*i. e.*, habitat of some species. Trees, evergreen shrubs. Distinguished by abounding in oleoresinous juice, leaves needle-shaped, entire, parallel-veined; flowers monœcious—staminate in catkins, with-

out calyx or corolla—pistillate in cones; ovules naked, 2 or more on upper surface of each scape (carpel); fruit woody cone; seeds naked, cotyledons 2 or many, wood without ducts, with discoid markings; temperate climates; stimulant, diuretic, emmenagogue, anthelmintic, expectorant, timber.

Genera: **1. Pinus. 2. Juniperus.**

TEREBINTHINA. TURPENTINE, *N.F.*

1. **Oleum Terebinthinæ. Oil of Turpentine,** *U.S.P.*
2. **Resina. Rosin,** *U.S.P.*

Pinus palustris, *Miller,* and other species, yielding exclusively terpene oils. } The volatile oil (1), and residue left (2) from distilling the oleoresin (turpentine).

Habitat. S. United States, Virginia to Texas, near the coast.

Syn. Long leaved (Yellow Pitch, Broom, Pitch, Swamp, Georgia) Pine; Common Frankincense, Terebinthina Communis, Thus Americanum, Frankincense, Crude Turpentine: 1. Ol. Tereb., Turpentine Oil, Spirits of Turpentine; Fr. Térébinthine (du Pin) de Bordeaux; Essence de Térébenthine officinale; Ger. (Gemeiner) Terpentin; Terpentinöl: 2, Resin, Colophony; Fr. Résine blanche (jaune); Ger. Colophonium, Kolophonium, Geigenharz.

Pi'nus. L. see etymology, page 72, of Pinaceæ.

Pa-lus'tris. L. *paluster,* swampy—*i. e.,* it inhabits swamps or near marshy places.

Ter-e-bin'thi-na. L. *terebinthus;* Gr. τερέβινθος, of or from the *terebinth—turpentine tree.*

Tur'pen-tine, fr. *turbentine, terebinthine, terebinthina.*

PLANT.—Large tree, 18–30 M. (60–100°) high, .3–.6 M. (1–2°) thick; bark thin, scaled, furrowed; wood hard, resinous; leaves many, crowded at end of branches, in 3's, 25–40 Cm. (10–16′) long, very narrow, sharp-pointed, triquetrous, in clusters surrounded by a sheath 25 Mm. (1′) long; flowers sterile in violet aments, 5 Cm. (2′) long; Fruit cone, large, oblong, 15–25 Cm. (6–10′) long, scales armed with short spine. Oleoresin—Terebinthina, Turpentine, *N.F.* Concrete oleoresin containing not more than 2 p. c. of foreign matter, occurs in yellowish, opaque masses, lighter internally, sticky, more or less glossy, brittle in cold; odor and taste characteristic; freely soluble in alcohol, ether, chloroform, glacial acetic acid; alcoholic solution acid reaction; rarely seen as yellow, opaque, viscid liquid.

CONSTITUENTS.—(CONCRETE) OLEORESIN: Volatile oil 20–30 p. c., Rosin (resina, resin) 50–60 p. c., bitter principle, formic, succinic, and possibly other resin acids—pinic and sylvic acids.

1. **Oleum Terebinthinæ. Oil of Turpentine,** $C_{10}H_{16}$.—Obtained by distilling with water or steam the (concrete) oleoresin (turpentine); it is a colorless liquid, characteristic odor and taste, both becoming stronger and less pleasant on aging or exposure (owing to formation of ozone, resin, formic and acetic acids), soluble in 5 vols. of alcohol, sp. gr. 0.861, rotation — dextro (variable), with hydrochloric acid

forms artificial crystalline camphor, $C_{10}H_{16}HCl$; contains chiefly *d*-pinene (French oil *l*-pinene), also derivatives of pinene, and often camphene and fenchone. *Tests:* 1. Evaporate 5 cc. over boiling water—residue .1 Gm. (abs. of petroleum, paraffin, rosin oils). 2. Expose to air 3 drops on unsized white paper—evaporates without leaving permanent stain (abs. of fixed oils). 3. Shake vigorously 5 cc. with equal volume of hydrochloric acid—only a light straw-yellow color in either acid or oily layer on standing 5 minutes, no brown or green. Must be added to fuming acids drop by drop, and should be kept cool, in well-stoppered containers.

FIG. 16.—*Pinus palustris.*

ADULTERATIONS. — Tar oils, kerosene, petroleum benzin, paraffin oils, rosin oil, etc.

2. **Resina. Rosin.**—This residue, left after distilling off the volatile oil from the (concrete) oleoresin (turpentine), is usually in sharply angular, translucent, amber-colored fragments, frequently covered with a yellow dust, fracture brittle at ordinary temperatures shiny and shallow-conchoidal; odor and taste slightly terebinthinate; freely soluble in alcohol, ether, benzene, glacial acetic acid, fixed or volatile oils, dilute solutions of the fixed alkali hydroxides; contains anhydride of abietic acid, $C_{44}H_{62}O_4$, 80–90 p. c., pinic and sylvic acids. *Tests:* 1. Alcoholic solution—acid; sp. gr. 1.08. 2. Easily fusible and burns with a dense yellowish smoke; ash .05 p. c. 3. Shaken with warm diluted alcohol—abietic anhydride converted into abietic acid, $C_{44}H_{64}O_5$, crystalline; boiled with alkaline solution—greasy salts of abietic acid (rosin soap); distil with super-heated steam—benzene and toluene. The varieties depend upon color, and this upon degree of heat employed in distillation; the older the trees, the greater the yield of rosin, the smaller the yield of oil.

Commercial.—The *P. palustris* (*P. austra'lis*—*i. e.*, southern) grows in dry sandy soil from the sea to 100 miles (160 Km.) inland, the young trees resembling brooms, the older furnishing (Florida, Georgia, N. and S. Carolina) most of the turpentine and rosin of commerce. The oleoresin secretes in the sapwood, and sparingly exudes spontaneously, so that to obtain it economically on a large scale the trees are *cornered* and *chipped*, which consists in removing, according to size of tree, one or two sections of bark—each one-fourth the entire circumference, and a foot from the ground upward 4–5 feet—then hacking the exposed wood in shape of the letter L, which may be extended slightly higher every few weeks to increase the flow. Formerly at the base of each decorticated section the experienced axman cut a triangular-shaped cavity (box—*boxing*), 4–8 pints (2–4 L.), capacity, to

catch the exudation, which was ladled out with "turpentine dippers" every 2–3 weeks, poured into barrels (250 pounds; 110 Kg.) and subsequently distilled at a nearby station. But these deep-seated wounds were so depleting as to render the trees worthless, save for lumber, in 4–5 years, consequently this method has been replaced by the less destructive "cup and gutter system," which consists in suspending from a zinc nail near the base of scarified section a detachable terra cotta (Herty) or zinc cup, similar in appearance to the quart-flower pot, and above that nailing at incline, on either side of median line, a zinc gutter, 6 x 2′, to direct flow into the cup, which, when filled, is easily removed, emptied into barrels and returned. The first season's yield is about 100 gallons per 100 trees, diminishing thereafter. The "crude" begins to flow early in March, becomes most rapid July-August when hot and dry, then slackens September-October. The first year's product is best, *virgin dip,* yielding 6½ gallons (24 L.) of oil per barrel and "window-glass rosin;" succeeding years give *yellow dip,* yielding 4 gallons (15 L.) of oil per barrel and medium grades of rosin; some hardens on trees, *scrapings, scrape,* yielding 2 gallons (7.5 L.) of oil per barrel and brownish-black rosin. In France covered pails or cups with lips, to avoid evaporation, chips, bark, etc., are used, into which the sap flows by a gutter through comparatively small hacked spaces, which, when alternating 5 working with 2 resting seasons, insures a handsome yield for 2 generations. The comminuted wood has been distilled with water, steam, alkali, etc., but with questionable satisfaction.

Fig. 17.—Cup and gutter system, cornered and chipped pine tree.

In the distillation of concrete oleoresin, when the volatile oil ceases to come over, the resin (rosin) while hot is run off from the bottom of still and strained into barrels, while the condensed distillate (oil), floating above the water, is dipped out and barrelled for market.

Preparations.—I. Oil: 1. *Oleum Terebinthinæ Rectificatum.* Rectified Oil of Turpentine. (Syn., Ol. Tereb. Rect., Rectified Turpentine Oil; Fr. Essence de Térébenthine rectifiée; Ger. Gereinigtes Terpentinöl.)

Manufacture: Shake thoroughly oil of turpentine, a convenient quantity, with an equal volume of sodium hydroxide solution, recover about three-fourths of the oil by distillation, separate the clear oil from the water, dry it by shaking with anhydrous calcium chloride or anhydrous sodium sulphate, filter. It is a colorless liquid, conforming to the properties and tests of oil of turpentine, sp. gr. 0.858; evaporate 5 cc.—residue .015 Gm. Should be kept cool, dark, in well-stoppered, amber-

colored bottles, and dispensed when oil of turpentine is required for internal use. Dose, stimulant, diuretic, ♏v–30 (.3–2 cc.); anthelmintic, ʒss–4 (2–15 cc.), on sugar or emulsified.

Preps.: 1. *Emulsum Olei Terebinthinæ.* Emulsion of Oil of Turpentine. (Syn., Emuls. Ol. Tereb., Turpentine Emulsion; Fr. Emulsion d'essence de Térébenthine; Ger. Terpentinölemulsion.)

Manufacture: 15 p. c. Add to dry bottle acacia 15 Gm., then rectified oil of turpentine 15 cc. and water exactly 10, agitate briskly until emulsified, add water q. s. 100 cc. Dose, ʒj–8 (4–30 cc.).

2. *Terpini Hydras.* Terpin Hydrate, $C_{10}H_{18}(OH)_2.H_2O$. (Syn., Terpin. Hyd.; Fr. Dihydrate de térébenthène (terpilène); Ger. Terpinum hydratum, Terpinhydrat.)

Manufacture: This hydrate of the dihydric alcohol terpin is obtained by mixing in a shallow dish rectified oil of turpentine (4), alcohol (3), nitric acid (1), allowing to stand 3–4 days, collecting crystals, draining, drying on filter paper, recrystallizing from alcohol rendered slightly alkaline to remove adhering acid. It is in colorless, lustrous, rhombic prisms, nearly odorless, slightly aromatic (resembling fresh lilacs, but not turpentine); somewhat bitter taste, efflorescent in dry air; soluble in water (200), boiling water (34), alcohol (13), boiling alcohol (3), chloroform (135), boiling glacial acetic acid (1); hot, saturated aqueous solution not acid to litmus. *Tests:* 1. Heated slowly at 100° C. (212° F.)—sublimes in fine needles; quickly heated—melts at 116° C. (241° F.) with the loss of water; also loses water of crystallization slowly over sulphuric acid. 2. Hot aqueous solution with a few drops of sulphuric acid—turbid, developing a strongly aromatic odor; incinerate 2 Gm.—ash .05 p. c. Should be kept cool, in well-closed containers. Dose, gr. 2–15 (.13–1 Gm.).

Preps.: 1. *Elixir Terpini Hydratis, N. F.*, 1.75 p. c. Prep.: 1. *Elixir Terpini Hydratis et Codeinæ, N. F.*—codeine $\frac{1}{5}$ p. c.; 2. *Elixir Terpini Hydratis et Creosoti Compositum, N. F.*, .44 p. c. + creosote .44, calcium glycerophos. .875, sodium glycerophos. .875. Dose, each, ʒj–2 (4–8 cc.).

2. *Terebenum.* Terebene, $C_{10}H_{16}$. (Syn., Tereben.; Fr. Terebène; Ger. Tereben.)

Manufacture: This liquid, consisting of dipentene (chiefly) and other hydrocarbons (terpinene, cymol, camphene, etc.) is obtained by adding gradually sulphuric acid (1) to oil of turpentine (20), allowing to stand for 24 hours, removing supernatant layer, neutralizing with chalk, distilling, further rectifying with steam. It is a colorless, thin liquid, rather agreeable, thyme-like odor, aromatic, somewhat terebinthinate taste, soluble in alcohol (3), slightly in water; on exposure to light gradually becomes resinified and of acid reaction, sp. gr.

0.863, boils at 166° C. (331° F.). *Impurities:* Rosin, unaltered oil of turpentine. Should be kept dark, in well-closed containers. Dose, ℥v–15 (.3–1 cc.).

3. *Ceratum Cantharidis*, 15 p. c. 4. *Linimentum Terebinthinæ, Kentish Ointment, N. F.*, 35 p. c., + rosin cerate 65. 5. *Linimentum Opii Compositum, N. F.*, 22 p. c. 6. *Linimentum Terebinthinæ Aceticum, Linimentum Album, Stoke's Liniment, St. John Long's Liniment, N. F.*, 40 p. c.—triturate 40 cc. + 2 fresh eggs + yolks of 2 other eggs, oil of lemon 16; then add acetic acid 80, water q. s. 1000 cc. 7. *Petroxolinum Sulphuratum Compositum, N. F.*, 30 cc. in 100 cc. product.

II. Rosin: 1. *Ceratum Resinæ*. Rosin Cerate. (Syn., Cerat. Res., Basilicon Ointment, Unguentum Tetrapharmacum; Br. Unguentum Resinæ; Fr. Cérat (onguent) de Résine anglais; Ger. Königssalbe, Harzsalbe, Zugsalbe.)

Manufacture: 35 p. c. Heat until liquefied rosin 35 Gm., add yellow wax 15, lard 50, strain, allow to congeal, stirring occasionally; in cold weather may use yellow wax 12, lard 53.

Prep.: 1. *Linimentum Terebinthinæ, N. F.*, 65 p. c., see above.

2. *Emplastrum Adhæsivum*. Adhesive Plaster. (Syn., Emp. Adhæs., Emplastrum Elasticum, Rubber Adhesive Plaster; Fr. Emplâtre caoutchouté simple; Ger. Kautschukheftpflaster.)

Manufacture: Mix mechanically rubber 20–30 p. c., resins, waxes, and an absorbent powder (zinc oxide, orris root or starch), and spread upon cotton cloth.

3. *Ceratum Cantharidis*, 17.5 p. c. 4. *Ceratum Resinæ Compositum, N. F.*, 22.5 p. c. 5. *Solutio Resinæ Chloroformica, N. F.*, 20 p. c.

III. Oleoresin: 1. *Ceratum Resinæ Compositum, Deshler's Salve, N. F.*, 11.5 p. c.—melt rosin 22.5 Gm.; yellow wax 22.5, turpentine 11.5, prepared suet 30, add linseed oil 13.5, strain, stir.

Properties. I. Oil of Turpentine and Oleoresin.—Internally – stimulant, carminative, cathartic, anthelmintic, hemostatic, expectorant, diuretic, diaphoretic, antipyretic. Externally—rubefacient, irritant, counter-irritant, antiseptic, disinfectant; contracts vessels, increases peristalsis, gastric secretion, stimulates heart, depresses nervous system. Large doses produce gastro-enteritis, vomiting, diarrhea, suppressed urine, lumbar pains, urethral burning, hematuria, strangury, insensibility, death by paralyzed respiration. It is excreted by the skin, bronchi, and kidneys; inhaling vapors give nasal, ocular, and renal irritation.

II. Terpin Hydrate.—Antiseptic (arresting the development of tubercle bacilli), expectorant, diuretic, diaphoretic.

III. Terebene.—Stimulant, disinfectant, expectorant, astringent.

IV. Resin.—Antiseptic, slight stimulant.

Uses.—I. Oil of Turpentine and Oleoresin: Internally—chronic bronchial catarrh, cystitis, gonorrhea, leucorrhea, gleet, chronic urinary troubles, piles, hemorrhages, puerperal fever, inflammation of bowels, traumatic erysipelas, intestinal worms, pneumonia, phos-

phorus-poisoning (old oil). Externally—rheumatism, sciatica, lumbago, neuralgia, bronchitis, pleurisy, peritonitis, tympanites, renal colic, gangrene, sprains, wounds, scabies, ringworms, enlarged glands, burns, frost-bites, colic; vapors of oil in whooping-cough, diphtheria, laryngitis. Often associated with various liniments, chloroform, camphor, olive oil, narcotic extracts, etc. The oleoresin may be given in pill form, hardened with magnesium oxide. Dose, gr. 15–60 (1–4 Gm.).

II. Terpin Hydrate.—Acute and chronic bronchitis, hay fever, whooping-cough, chronic nephritis, chronic cystitis, gonorrhea.

III. Terebene.—Chronic bronchitis by inhalation and on sucrose (sugar) fermentative dyspepsia.

IV. Resin.—Indolent ulcers, sores, wounds, in plasters, ointments, as emulsifying agent, chronic enteritis.

Poisoning: Have giddiness, gastro-enteritis, strangury, bloody, scanty urine, with violet odor; may have purging, cyanosis, dilated pupils, stertorous breathing, feeble, rapid pulse, coma, collapse. Give emetics, if no purging use enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

Allied Products:

1. **Pix Pini, Pine Tar,** *U.S.P.*—(Syn., Pix Pin., Pix Liquidæ, Resina Empyreumatica Liquida; Fr. Goudron végétal; Ger. Holztheer, Theer.) A product obtained by the destructive distillation of the wood of *Pinus palustris* or other species of *Pinus* (*P. Tæ'da*, *P. rig'ida*, *P. sylves'tris*, and *Larix sibir'ica*.)

Manufacture: Refuse pine wood, cut in billets, is stacked compactly and covered with earth, except an opening at the apex for ignition and the escape of gases; slow combustion without flame is allowed to proceed, while a ditch at the bottom serves to run off the tarry liquid that is ladled into barrels; the wood is converted into charcoal and this becomes a valuable by-product. In Europe permanent clay furnaces are used over and over. It is a true, impure turpentine, semi-liquid, viscid, blackish-brown, non-crystalline, translucent in thin layers, granular and opaque with age: odor empyreumatic, terebinthinate, taste sharp, empyreumatic; miscible with alcohol, ether, chloroform, glacial acetic acid, fixed or volatile oils; heavier than water, slightly soluble in it—solution pale yellowish-brown, acid reaction; ash .25 p. c. *Test:* 1. Shake 1 cc., for 10 minutes, with water 10, add to filtrate a drop of ferric chloride T. S.—greenish, then brown color. Dose, gr. 5–30 (.3–2 Gm.), in pill.

Constituents.—Acetic acid, small quantities of formic, propionic, capronic acids, acetone, methyl alcohol, mesit, toluol, xylol, cumol, methol (all passing over with the light oil of tar), naphthalene, pyrene, chrysene, paraffin, phenols, creosote (25 p. c.), pyrocatechin, empyreumatic resin.

Preparations.—1. *Unguentum Picis Pini.* Tar Ointment. (Syn., Ung. Pic. Pin., Unguentum Picis Liquidæ: Fr. Pomatum cum Pice, Pommade de Goudron; Ger. Theersalbe.)

Manufacture: 50 p. c. Melt yellow wax 15 Gm., add petrolatum 35, and to melted mixture pine tar 50, previously warmed, incorporate thoroughly, strain, stir until congealed.

2. *Oleum Picis Rectificatum.* Rectified Oil of Tar. (Syn., Ol. Pic. Rect., Oleum Picis Liquidæ Rectificatum; Fr. Huile volatile de Goudron rectifiée; Ger. Gereinigtes Theeröl.)

Manufacture: Distil wood-tar and collect that fraction of the distillate lighter than water, redistil. This volatile oil is a thin liquid, dark reddish-brown color, strong, empyreumatic odor and taste; soluble in alcohol, solution being acid, sp. gr. 0.975; contains hydrocarbons, phenols, acetic acid and other acids, undetermined empyreumatic products present in tar, being largely oil of turpentine.

Dose, ♏ij–5 (.13–.3 cc.), in pills, water, or syrup.

Preps: 1. *Syrupus Picis Pini.* Syrup of Pine Tar. (Syn., Syr. Pic. Pin., Syrupus Picis Liquidæ, Syrup of Tar, Syrupus Piceus; Fr. Sirop de Goudron; Ger. Theersirup.)

Manufacture: $\frac{1}{10}$ p. c. Mix oil .1 cc. with water 45, agitate mixture frequently during 15 minutes, set aside 24 hours, shaking occasionally; dissolve in filtrate sucrose 85 Gm., add water q. s. 100 cc., mix thoroughly, strain. Dose, ʒj–4 (4–15 cc.).

2. *Unguentum Picis Compositum, N.F.*, 4 p. c. + zinc oxide 3, tincture of benzoin 2.

3. *Glyceritum Picis Pini, N.F.*, 6.3 p. c., glycerin 25.

PROPERTIES.—Pine tar similar to oil of turpentine, but milder, scarcely ever vesicates, stimulant, expectorant, counter-irritant, insecticide. Internally—disturbs digestion, large doses may cause vomiting, colic, pain, headache, dark urine similar to phenol.

USES.—Internally—bronchitis, phthisis, vesical catarrh, constipation. Externally—scabies, scaly eruptions, eczema, burns, boils, sores, ulcers, gangrene, fissured nipples, hemorrhoids; fumes destroy foul odors.

2. *Pix Carbonis, Coal Tar, Pix Lithanthracis, N.F.*—The tar obtained as a by-product in the destructive distillation of coal for illuminating gas. A nearly black, thick liquid or semi-solid, heavier than water, odor characteristic, naphthalene-like, taste sharp burning; soluble in benzene, carbon disulphide, chloroform, partly so in alcohol, acetone, methyl alcohol, purified petroleum benzin, slightly so in water, imparting its characteristic odor and taste; alkaline reaction; burns with reddish, luminous sooty flame, being consumed by strong heat, ash 2 p. c.; 1. *Liquor Picis Carbonis,* Liquor Carbonis Detergens, 20 p. c. + quillaja 10 (70 p. c. alcohol).

3. *Lar'ix Larix* (*L. europæ'a, Pinus Larix*), *Venice Turpentine* (*Terebinthina Laricis—Veneta*).—Obtained from heartwood by bore holes; yellowish-green, transparent, fluorescent, odor terebinthinate, balsamic, soluble in alcohol.

4. *European Turpentine* from *P. Pinas'ter, P. Laric'io, P. sylves'tris, P. rotunda'ta* and other allied species; similar to oleoresin terebinthina.

PINACEÆ

5. *Chian Turpentine, Terebinthinæ Chia* (*Pista'cia Terebin'thus*) from Island of Chio or Scio. It is a greenish-yellow liquid, hardens to transparent mass, odor fennel-like, terebinthinate, taste mildly bitter. Once used for uterine cancer, but now in disfavor. Dose, gr. 20 (1.3 Gm.).

Allied Plants:

1. *Pinus Tæ'da, Loblolly, Old Field* or *Frankincense Pine.*—Delaware, Florida, thence Texas, Arkansas. Grows along with *P. palustris*, and like it is a large tree, 18–30 M. (60–100°) high, but leaves (15–25 Cm.; 6–10′ long) and cones (7.5–12.5 Cm.; 3–5′ long) are smaller. This yields not near so great a per cent of oleoresin as official plant, but one quite as good, consequently it is utilized for this and other purposes.

2. *P. sylves'tris, Wild Pine, Scotch Fir.*—Europe. Tree 21–24 M. (70–80°) high, leaves and cones only 5–7.5 Cm. (2–3′) long; this yields much of the common European turpentine; *P. Pinaster* (*P. marit'ima*), S. Europe, much used for obtaining turpentine, pitch, and tar.

3. *P. Stro'bus, Pinus Alba, White Pine Bark, N.F.*—The dried inner bark, with not more than 2 p. c. of outer bark and 2 p. c. of foreign organic matter; N. America. Large handsome tree. Bark in flat pieces of variable size, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick, yellowish, brownish, periderm patches, cottony, scattered pits, inner surface finely striate; fracture short; odor slight, terebinthinate; taste slightly mucilaginous, bitter, sweet, astringent. Powder, brownish—starch grains, calcium oxalate prisms, resin, few tracheids. Dose, ʒss–1 (2–4 Gm.); 1. *Syrupus Pini Albæ Compositus*, 8.5 p. c. Prep.: 1. *Syrupus Pini Albæ Compositus cum Morphina*, morphine sulphate $\frac{1}{25}$ p. c. Dose, each, ʒss–1 (2–4 cc.).

4. *Thu'ja occidental'is, Thuja, Arbor Vitæ, N.F.*—The dried, leafy, young twigs with not more than 2 p. c. of stems over 4 Mm. ($\frac{1}{6}$′) thick or other foreign organic matter—only the recently dried drug should be used; Canada, United States. Handsome evergreen tree, resembling *Chamæcyp'aris sphæroi'dea* (*Cupres'sus thyoi'des*) 6–15 M. (20–50°) high, trunk crooked, bark pale, shreddy, wood light, soft, durable. Twigs fan-shaped, flattened, leaves appressed in 4 rows, edges boat-shaped, glands on the back; odor strongly balsamic, aromatic, pungent; taste camphoraceous, terebinthinate, bitter. Powder, greenish-brown—chlorenchyma, stomata, guard cells, long fibers, oblique pores; solvent: alcohol; contains volatile oil 1 p. c., resin, tannin, pinipicrin, thujin, thujigenin, ash 7 p. c. Stimulant, diuretic, irritant, emmenagogue (resembling savin); fevers, bronchial catarrh, rheumatism, dropsy, worms, ulcers, warts. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Thujæ* (alcohol).

PINUS PUMILIO. DWARF PINE.

Oleum Pini Pumilionis. Oil of Dwarf Pine Needles, *U.S.P.*

Pinus montana, *Miller.* — A volatile oil distilled from the fresh leaves, yielding not less than 5 p. c. esters calculated as bornyl acetate.

Habitat. C. Europe: Tyrolese Alps, Carpathian Mountains, 1300–2500 M. (4200–8200°) elevation.

Syn. Dwarf Pine, Mountain Pine; Ol. Pin. Pumil., Dwarf Pine Oil, Pine Needle Oil; Ger. Latschenkieferöl, Krummholzöl.

Mon-ta'na. L. *montanus*, mountainous—*i. e.*, preferred place of growth.

Pu-mil'io. L. *pumilio, onis*, fr. *pumilus*, dwarfish, diminutive—*i. e.*, in reference to its small size.

PLANT.—Small tree, branches decumbent or knee-like, more or less erect; bark persistent, dark colored; leaves 2 in a sheath, 2–5 Cm. ($\frac{4}{5}$–2′) long, straight, scythe-shaped, obtuse apex, dull green, slightly glaucous; fruit (cones) ovoid, 4 Cm. ($1\frac{3}{5}$′) long, pyramidal protuberance on each scale on exposed side (outer).

CONSTITUENTS.—Volatile oil, resin, tannin, bitter extractive.

FIG. 18.—*Abies Abies* (*excelsa*).

Oleum Pini Pumilionis. Oil of Dwarf Pine Needles.—This volatile oil, distilled from the fresh leaves (needles), is a colorless, faintly yellowish liquid, pleasant, aromatic odor, bitter, pungent taste, sp. gr. 0.861, no portion distils below 165° C. (329° F.), levorotatory, neutral, slightly acid; contains *l*-pinene, *l*-phellandrene, sylvestrene, bornyl acetate (to which odor is due), cadinene. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.), on sugar, capsules, pastilles.

PROPERTIES AND USES.—Antirheumatic, expectorant, stimulant, antiseptic; chronic rheumatism (internally), chronic bronchitis,

laryngitis (inhaled); may rub on rheumatic joints, and cover with cotton; inhalant or vapor (oil 10 cc., + magnesium carbonate 5 Gm. + distilled water q. s. 100 cc.; of this add ʒj (4 cc.) to hot water ʒxx (600 cc.) and inhale through it; allays irritation and diminishes bronchial secretion, catarrhal inflammation. A juice (Hungarian balsam) exudes spontaneously from the tips of young branches, to which flasks are attached for easy collection, and this possesses properties of turpentine as well as of the oil.

Allied Plants:

1. *Ab'ies Abies* (*excel'sa*), *Pix Burgundica, Burgundy Pitch.*—The prepared resinous exudation, U. S. P. 1820–1890; S. Europe (Burgundy province, France). Lofty tree, 24–45 M. (80–150°) high; leaves short, 4-cornered, green; flowers, staminate and pistillate; fruit purple, cylindrical; scales oval. The oleoresin (Jura turpentine) is obtained from incisions made through the bark, after which it is melted in water and strained, thus yielding the once official product. It is yellowish-brown, hard, yet gradually conforming to the container, shining, conchoidal fracture, opaque or translucent, brittle, softened by heat, aromatic, terebinthinate, sweetish, not bitter; contains volatile oil 5 p. c., water 5–10 p. c. (absorbed during treatment), remainder is resin (chiefly abietic acid). Stimulant, counter-irritant, in plasters, as a base and for support; rheumatism, joint affections, chest troubles, pleurisy, bronchitis, catarrh, asthma, hepatitis, phthisis, pneumonia.

2. *A. balsam'ea, Terebinthina Canadensis, Canada Turpentine.*—The liquid oleoresin (balsam of fir), U. S. P. 1820–1900; Canada, United States, chiefly Laurentine Mountains, Quebec. Beautiful, ornamental tree (American Silver Fir), 9–15 M. (30–50°) high, pyramidal shape; bark smooth, reddish-gray when young, filled with blisters (reservoirs) containing the oleoresin; leaves 2 Cm. (⅘′) long, linear, silvery beneath; flowers, staminate—catkins, pistillate—cones, 5–10 Cm. (2–4′) long, 2.5 Cm. (1′) broad; pollen bright yellow; seed with wing. Oleoresin (Canada turpentine), viscid, yellowish, transparent, odor agreeable; taste terebinthinate, bitter, acrid, soluble in ether, chloroform, benzene; collected by puncturing vesicles with the sharp-pointed nozzle of the "balsam-collector's" can; contains volatile oil 24 p. c., acid resin 63 p. c., indifferent resin 12 p. c., acids (4)—canadinic, canadolic, *a*- and *b*-canadinolic. Properties and uses, similar to oil of turpentine, except this dries into an adhesive, transparent varnish, thus becoming valuable in microscopic technique. Dose, gr. 15–60 (1–4 Gm.). *A. Fra'seri.*—Resembles the preceding, but cones only 5 Cm. (2′) long, sharp-pointed scales projecting and recurved; New England, North Carolina, in mountains; used for collecting balsam of fir.

Fig. 19. — Can for collecting balsam of fir.

3. *A. Pi'cea* (*pectina'ta*), *Strassburg Turpentine* (*Terebinthina Argentoraten'sis*).—Vosges. Obtained like Canada balsam, chiefly dif-

fering in odor (lemon); taste bitter, not acrid; completely soluble in absolute alcohol. *A. Menzie'sii, Oregon Balsam of Fir,* resembles Canada balsam when fresh, but becomes gradually granular and opaque.

4. *Tsu'ga (Abies) canaden'sis, Pix Canadensis (Canada Pitch, Hemlock Pitch).*—Prepared resinous exudation, U.S.P. 1830–1880; N. America. Hemlock spruce is an evergreen tree 18–24 M. (60–80°) high, .6–1 M. (2–3°) thick, trunk straight, uniform size for 12–15 M. (40–50°), bark rough, leaves 18 Mm. ($\frac{3}{4}'$) long, 2 Mm. ($\frac{1}{12}'$) wide, in 2 rows, numerous, glaucous, silvery beneath, cones ovate, 2.5 Cm. (1′) long, resin (oleoresin) reddish-brown, translucent, or opaque, nearly hard, brittle, fracture shining, conchoidal: odor mild, balsamic, terebinthinate. Oleoresin is obtained by exudation, incision, or boxing; yield small. Used as stimulant, irritant, in plasters. *Emplastrum Picis Canadensis, U. S. P.* 1860–1880.

5 *Pini'tes succin'ifer (Pi'cea succinif'era), Succinum (Amber).*—Fossil resin, U. S. P. 1820–1850; Baltic Sea, Prussia, coal mines. There are 50 Pinaceæ species that yield this resin. Such trees have been submerged under seawater, and from time to time yield by natural exudation this oleoresin, which is found along shores under and above water in irregular-sized pieces, that of 13 pounds (6 Kg.) being, so far, the largest; it is rough, dull, hard, brittle, fracture conchoidal, glossy, transparent, yellowish-red, sp. gr. 1.09, aromatic when heated, tasteless, melts at 288° C. (550° F.), yielding succinic acid, if heated higher get water, volatile acids, empyreumatic oil; contains succinic acid, $C_4H_6O_4$, several resins. Used for preparing succinic acid and (empyreumatic) oil of amber, for fumigation, in the arts. *Oleum Succini, U. S. P.* 1820–1880. *Oleum Succini Rectificatum, U. S. P.* 1830–1870. Stimulant, antispasmodic, diuretic; hysteria, whooping-cough, infantile convulsions, intestinal irritation, amenorrhea. Externally—rheumatism, rubefacient liniments. Dose, ♏v–15 (.3–1 cc.).

6. *Ag'athis loranthifo'lia (Dam'mara), Dammar.*—E. India. A spontaneous resinous exudation, in transparent, straw-colored rounded masses, almost odorless, and tasteless, fracture conchoidal; contains resin of which 40 p. c. is insoluble in alcohol and 60 p. c. soluble; by distillation get terpene, $C_{10}H_{16}$. Used mostly in varnishes, rarely in plasters. That from New Zealand—*Kauri Resin*—is found also fossil and often sold as copal.

7. *Cal'litris quadrival'vis, Sandaraca (Sandarac).*—N. W. Africa. It is a resin which exudes spontaneously or from incisions made through the bark; occurs in elongated pale yellow tears 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}'$) long, covered with whitish dust, of a glass-like luster, transparent, hard, brittle; odor and taste terebinthinate, balsamic, bitter, soluble in hot alcohol, ether; it resembles peas in size, often mixed with mastic, owing to its cheapness, but distinguished by being pulverulent when chewed (and not adhesive as with mastic); contains 3 resins, differing in solubility, also bitter principle; according to Tschirch—sandura-

PINACEÆ

colic acid 85 p. c., callitrolic acid 10 p. c., volatile oil (amount depending upon freshness); mild stimulant; mainly used in varnishes.

JUNIPERUS. JUNIPER BERRY, *N.F.*

Oleum Juniperi. Oil of Juniper, *U.S.P.*

Juniperus communis, *Linné.* { A volatile oil distilled from the dried ripe fruit.

Habitat. N. America (Canada, N. United States), Asia, Europe, N. Africa; dry woods, hills.

Syn. Juniper Bush, Juniper Berries, Fructus (Baccæ) Juniperi; Fr. Genièvre, Baies de Genièvre; Ger. (Gemeiner) Wachholderbeeren; Ol. Junip., Juniper Oil, Oil of Juniper Berries, Oleum Fructus (Baccæ) Juniperi; Fr. Essence de Genièvre; Ger. Wachholder(beer)öl.

Ju-nip'e-rus. L. fr. Celtic *juniperus,* rough—*i.e.,* its foliage; or fr. L. *juvenis,* young, + *parere,* to produce—*i.e.,* young fruit, leaves, etc., are continually replacing the old.

Com-mu'nis. L. common, general—*i. e.,* the usual or ordinary kind.

Plant.—Evergreen shrub 2–5 M. (6 15°)high, with many close branches, some often prostrate; leaves narrow, longer than fruit, 12 Mm. ($\frac{1}{2}'$) long, in whorls of 3's, sharp-pointed, channeled, deep green; flowers diœcious—staminate catkins, pistillate cones. Fruit (galbulus)—Juniperus, Juniper Berry, *N.F.* The carefully dried ripe fruit with not more than 10 p. c. of immature or discolored berries and 3 p. c. of foreign organic matter. It is nearly globular, 8 Mm. ($\frac{1}{3}'$) thick, blackish-purple, blue-gray bloom, apex 3-furrowed—cohesion of 3 fleshy bracts; internally loosely fleshy, many schizogenous cavities, 3 ovate seed, oil-glands on surface, ripens second year; odor aromatic; taste sweet, pleasant, terebinthinate, bitter. Powder, dark brown—stone cells, calcium oxalate prisms, polygonal cells, aleurone grains, oil globules, resin masses.

Constituents.—Volatile oil .5–2.5 p. c., sugar 15–30 p. c., resin 10 p. c., juniperin, proteins 4 p. c., fat, wax, malates, formic and acetic acids.

Oleum Juniperi. Oil of Juniper.—Obtained from the dried ripe fruit by distillation with salt and water, or steam; it is a colorless, faintly green or yellow liquid, characteristic odor and taste of juniper berries, soluble in 4 vols. of alcohol with not more than slight cloudiness, neutral, slightly acid, sp. gr. 0.870, levorotatory; contains chiefly pinene, $C_{10}H_{16}$, with some cadinene, $C_{15}H_{24}$, juniper camphor, and an ester to which odor and taste are due. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–15 (.3–1 cc.).

Preparations.—Berry: 1. *Fluidextractum Juniperi, N.F.* (80 p. c. alcohol), dose, ʒj–2 (4–8 cc.): Prep.: 1. *Elixir Buchu, Juniperi et Potassi Acetatis, N.F.,* 7.5 p. c. 2. *Fluidextractum Buchu Compositum, N.F.,* 12.5 p. c.: Prep.: 1. *Elixir Buchu Compositum, N.F.,* 25 p. c.

Extract; Infusion; Succus Juniperi Inspissatus (Ger.), 20 p. c. Oil: 1. *Acetum Aromaticum*, *N.F.*, $\frac{1}{20}$ p. c. *Spirit*, 5 p. c. + alcohol, ʒj–4

Fig. 20.—*Juniperus communis.*

Fig. 21.—Juniperus: *a*, fertile catkin and longitudinal section; *b*, galbulus and transverse section; *c*, seed and longitudinal section magnified.

(4–15 cc.). *Compound Spirit*, $\frac{2}{5}$ p. c. —oil of juniper $\frac{2}{5}$ p. c., oil of caraway $\frac{1}{20}$, oil of fennel $\frac{1}{2}$, 70 p. c. alcohol q. s. 100 cc., ʒj–4 (4–15 cc.—substitute for gin.).

Properties.—Similar to turpentine; stimulant, diuretic, anodyne, emmenagogue, carminative, stomachic, antiseptic.

Uses.—Renal dropsy, vesical catarrh, rheumatic pains, swellings.

JUNIPERUS OXYCEDRUS. PRICKLY CEDAR.

Oleum Cadinum. Oil of Cade, *U.S.P.*

Juniperus Oxycedrus, *Linné.* { An empyreumatic volatile oil obtained from the wood.

Habitat. S. Europe, Spain.

Syn. Prickly (Spanish, Berry-bearing) Cedar, Large Brown-fruited Juniper; Ol. Cadin., Cade Oil, Oil of Juniper Tar, Oleum Juniperi Empyreumaticum (Nigrum); Fr. Huile de Cade; Ger. Kadeöl, Takinöl, Spanisch-Cederöl.

Ox-y-ce'drus. L. fr. Gr. *ὀξύς*, sharp, pointed, + *κέδρος*, cedar—*i. e.*, cedar with pointed leaves.

Ca-di'num. L. fr. Fr. *cade*, juniper; Bohem. *kadik*, juniper—*i. e.*, European cedar.

Plant.—Shrub 2.4–3.7 M. (8–12°)high, resembling *J. commu'nis*, branches spreading, drooping; leaves medium size, awl-shaped, pointed, 2 furrows on upper edge; fruit 12 Mm. ($\frac{1}{2}'$) thick, reddish, shining, 2 white lines on apex.

Constituents.—Volatile oil, resin, tannin, extractive (acetic acid, pyroligneous acid, acetone, methyl alcohol, etc.).

Oleum Cadinum. Oil of Cade.—Should be dry (downward) distilled from the heartwood, similar to obtaining tar, pieces of wood being laid carefully upon one another and covered with earth except an opening at the top, thus permitting slow combustion; inverted

iron pots also are filled with billets, surrounded with worthless wood and set on fire, producing sufficient heat for distillation; product is caught in receptacles, set aside 15–20 days for separation of tarry and aqueous layers, the upper oily one constituting the commercial product. It is a dark brown, clear, thick liquid, tarry odor, warm, faintly aromatic, bitter taste, slightly soluble in water, imparting to it acid reaction, partially soluble in alcohol, petroleum benzin, completely soluble in ether (3), amyl alcohol, chloroform, glacial acetic acid, oil of turpentine, sp. gr. 0.980–1.055; contains phenols and sesquiterpene—cadinene, $C_{15}H_{24}$. *Test:* 1. Shake 1 part with warm distilled water (20); filtrate, + 3 drops of ferric chloride solution (1 in 1000)—red; or + silver ammonium nitrate T. S.—blackens (cold); or + alkaline cupric tartrate T. S. (hot)—red precipitate. *Impurities:* Rosin, rosin oil. The oil from wood of *J. communis* often substituted. Dose, ♏iij–5 (.2–.3 cc.).

Fig. 22.—*Juniperus Sabina.*

Preparations.—1. *Petroxolinum Cadinum, N.F.*, 25 cc. in 100 cc. of product. 2. *Linimentum Saponis Mollis Compositum, N.F.*, 2 p. c. 3. *Petroxolinum Sulphuratum Compositum, N.F.*, 10 cc. in 100 cc. of product. 4. *Unguentum Sulphuris Compositum, N.F.*, 15 p. c.

Properties. — Anthelmintic, externally parasiticide.

Uses.—Psoriasis, pityriasis rubra, chronic eczema, prurigo, psora, favus. This oil may replace the *U. S. P. Oleum Picis Rectificatum*, both having about the same effect.

Allied Plants:

1. *Juniperus Sabi'na, Savin, Shrubby Red Cedar.*—The tops, U.S.P. 1820–1900; Europe, Siberia, N. America, rocky banks, mountains. Evergreen shrub, procumbent or erect, 1–4.5 M. (3–15°) high, branched, bark greenish (young), brownish (old); flowers diœcious; fruit galbulus, bluish, size of a pea, 1–3-seeded. Tops yellowish-green, subquadrangular branchlets; leaves 4 rows, dark green, scale-like, ovate-lanceolate, acute, imbricated, shallow groove on back, roundish gland in middle; odor peculiar, terebinthinate; taste disagreeable, resinous, bitter; solvents: boiling water, alcohol; contains volatile oil 2–5–10 p. c., resin, tannin, salts (K, Ca). Diuretic, emmenagogue, ecbolic, irritant, hemagogue; amenorrhea, dysmenorrhea, menorrhagia, rheumatism, gout; warts, ulcers, dental caries, tinea capitis, polypi. *Poisoning:* Abdominal pain, vomiting, strangury, convulsions, coma—magnesium sulphate (full dose), demulcents, anodynes, stimulants. Dose, gr. 5–15 (.3–1 Gm.), in syrup, honey; fluidextract (alcohol), ♏v–15 (.3–1 cc.); cerate (25 p. c.), to prolong secretion from blisters, etc.; Infusion, Tincture.

2. *J. virginia'na, Red Cedar.*—The tops, U.S.P. 1820–1870; United States. Slow-growing evergreen, 6–24 M. (20–80°) high, 15–45 Cm. (6–18′) thick, branches spreading, horizontal near the ground; leaves small, glandular, ternate in pairs; odor of tops peculiar; taste pungent; contains volatile oil, resin, tannin; wood yields volatile oil (of red cedar) containing cedrene, $C_{15}H_{24}$, and cedrene camphor, $C_{15}H_{26}O$. Differs from *J. Sabina* in habit, smaller erect fruit, more acute leaves, reddish durable heartwood, yellowish sapwood, and weaker properties, but the tops and volatile oils may be substituted for each other. Branchlets bear excrescences (cedar apples), which are used as anthelmintic. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Class 6. ANGIOSPERMÆ (Seeds clothed, enclosed in an ovary).

Sub-Class 1. MONOCOTYLEDONES (Embryo with one cotyledon, stem endogenous, leaves parallel-veined).

6. GRAMINACEÆ. Grass Family.

Gram-i-na'se-e. L. fem. pl. of *gramin-eus* + aceæ, of or pertaining to grass—*gramen*, grass. Herbs, shrubs, or aborescent plants, largest endogenous order except Orchidaceæ. Distinguished by having leaves 2-ranked with split sheaths and ligule; stems (culms) hollow, closed at joints; flowers glumaceous, paleæ (chaff, husk) 2, stamens 3, hypogynous; anthers versatile; ovary superior, ovule 1; fruit caryopsis, stigma feathery, hairy; universal; purgative, poisonous, cereals, fodder, sugar, volatile oil.

Genera: **1. Zea. 2. Saccharum. 3. Hordeum.**

AMYLUM. STARCH, *U.S.P.*

Zea Mays, *Linné.* { The granules separated from grain, with a trace of foreign organic matter, yielding not more than .5 p. c. ash nor 14 p. c. moisture.

Habitat. S. America; cultivated in warm temperate zones.

Syn. Corn, Indian (Turkish) Corn, Maize, Mealies, Guinea (Turkey) Wheat; Amyl., Corn Starch; Fr. Maïs, Fécule (Amidon) de Maize; Ger. Mais, Amylum Tritici, Weizenstärke, Stärke, Kraftmehl, Maisstärke.

Ze'a. L. fr. Gr. ζάω, to live—*i. e.*, from its life-supporting properties to beast and man.

Ma'ys. L. *maydis*, Sp. *maiz*, fr. *mahiz*, its native name in the Haitian Island language, its native habitat.

Am'y-lum. L. starch, Gr. ἄμυλον = α, not, + μύλη, a mill—*i. e.*, so fine as not requiring to be ground in a mill.

Starch, fr. *stark*, strong, stiff, so called from its use in stiffening various substances.

Plant.—An annual; stem 1.2–4.5 M. (4–15°) high, erect, stiff, unbranched, grooved on one side, smooth, solid, with spongy center, jointed; roots fibrous; leaves many, linear, .6–1 M. (2–3°) long, 5–7.5

GRAMINACEÆ

Cm. (2–3′) wide, channeled; flowers monœcious—staminate spikelets numerous, in pairs, forming a long-stalked terminal panicle (tassel), —pistillate thick spikes, from the husks of which project long, slender styles and stigmas (silk); fruit, caryopsis (kernel) and rachis (cob) form the spike (ear), which is enclosed by the bracts of the spathe (husks); kernels (seed, grain) occur in 8–10–12 rows, or some even

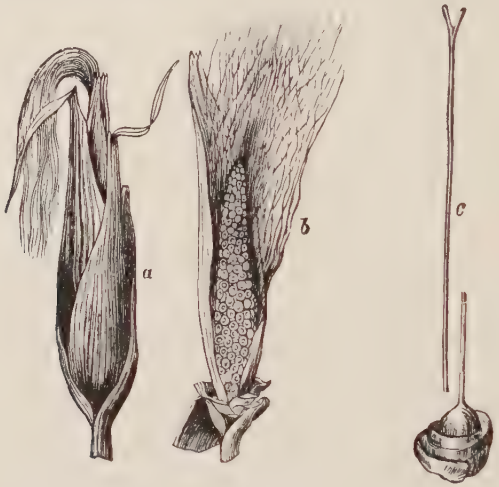


FIG. 23.—*Zea Mays: a*, spadiceous flower with styles protruding; *b*, the same freed from cover leaves reduced in size; *c*, a single style with stigma.

number—yellow, white, red, purple. STARCH, in fine powder, irregular, angular, white masses, consisting chiefly of polygonal, rounded, spheroidal starch grains, .003–.035 Mm. ($\frac{1}{83}$–$\frac{1}{250}$′) broad, usually with lenticular, 3-several-rayed central cleft (rounded—circular marking); insoluble in cold water, alcohol; inodorous; taste slight, characteristic. *Tests:* 1. With iodine T. S.—deep blue. 2. Boil 1 Gm. with water (15), cool—translucent, whitish jelly. 3. Incinerate—ash .5 p. c.; aqueous mixture neutral. 4. With diluted acids or diastase—dextrin, $C_{12}H_{20}O_{10}$, dextrose, $C_6H_{12}O_6$, water, H_2O, which reveals the starch formula to be $(C_6H_{10}O_5)_3$. 5. To 1 Gm. add distilled water 10 cc. + hydrochloric acid .5, + 3 drops of potassium ferrocyanide T. S.—no blue color within 5 minutes (abs. of iron). *Solvents:* water, glycerin—boiling. Dose, ʒss–2 (2–8 Gm.).

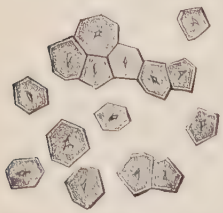


FIG. 24.—Corn starch.

ADULTERATIONS.—Allied starches, especially of wheat, potatoes (white and sweet), yam, etc., all recognized by the microscope in the shape of the granules.

Commercial.—Starch is prepared from the grain by soaking in hot water, to which an alkali sometimes is added, until the testæ are softened, then grinding under water and washing it upon large sieves

with water; by this means the starch is suspended in the water and will deposit upon being allowed to remain undisturbed for some hours; the gluten when present remains in the supernatant alkaline water or upon the sieve. When all the starch is deposited on the bottom of the container (tank), the liquid is racked off, the starch cut into blocks and carefully dried in suitable chambers. The finely ground corn meal may also be kneaded under a stream of running water until milkiness ceases, then allowing the milky water to subside.

CONSTITUENTS.—$C_6H_{10}O_5$, or a multiple of this, ash .5 p. c.

PREPARATIONS.—1. *Glyceritum Amyli.* Glycerite of Starch. (Syn., Glycer. Amyl., Plasma, Glycamyl; Br. Glycerinum Amyli, Glycerin of Starch; Fr. Glycéré d'Amidon, Glycérat simple (d'Amidon); Ger. Unguentum Glycerini, Glycerinsalbe.)

Manufacture: 10 p. c. Triturate, until homogeneous, starch 10 Gm., with water 20 cc., add this gradually to hot glycerin 70 cc., in porcelain dish, continue heat, below 144° C. (291° F.), until translucent jelly. 2. *Powdered Extracts: Belladonna, Cascara Sagrada, Colchicum, Colocynth, Hyoscyamus, Nux Vomica, Oxgall, Rhubarb, Stramonium, N.F.: Euonymus, Hydrastis, Ignatia, Krameria, Leptandra, Opium,* +, etc.—as excipient and dryer. 3. *Pasta, N.F.: Resorcinolis Fortis; Resorcinolis Mitis; Zinci.* 4. *Stili, N.F.: Acidi Salicylici.* 5. *Tabullæ, N.F.: Hydrargyri Chloridi Mitis; Sodii Bicarbonatis; Sulphuris et Potassii Bitartratis,* etc.

Unoff. Preps.: Iodized Starch (Amylum Iodatum), 95 p. c., + iodine 5, + little distilled water—bluish-black powder, ʒj–4 (4–15 Gm.). Paste, Poultice, Water.

PROPERTIES.—Nutritive, demulcent, protective, absorbent.

USES.—Mostly externally as a dusting-powder to allay itching and burning of the skin in erythema, urticaria, erysipelas, smallpox, to saturate bandages for fractures, as an injection for inflamed rectum or bladder, as a vehicle for enemata, to harden pills, antidote to iodine poisoning. Owing to starchy foods fermenting they should be avoided in fermentative dyspepsia.

Derivative Product:

1. *Zea Mays, Zea, Corn Silk, N.F.*—The fresh styles and stigmas, collected when corn is in milk, and used in the green condition when manufacturing pharmaceutical preparations. It is in slender filaments, 10–20 Cm. (4–8′) long, .4 Mm. ($\frac{1}{60}$′) thick, yellowish, reddish, brownish; stigmas bifid, segments slender, often unequal, .4–3 Mm. ($\frac{1}{60}$–$\frac{1}{8}$′) long. *Tests:* 1. Digest in diluted alcohol, filtered solution—pale purplish-red, or + acids—purplish, yellowish-red, or + alkalies—green, or + ferric chloride T. S.—olive-green, changing to greenish-brown, or + aqueous solution of alum—bluish, purplish; contains maizenic acid, resin, fixed oil, mucilage, sugar. Diuretic, demulcent, lithotriptic, alterative; cystitis, gravel, dropsy, gonorrhea, incontinence of urine. Dose, ʒj–2 (4–8 Gm.); 1. *Fluidextractum Zeæ* (diluted alcohol), dose, ʒj–2 (4–8 cc.). Prep.: 1. *Elixir Sabal et Santali Compositum,* 26 p. c. *Infusion* 10 p. c., ℥j–2 (30–60 cc.).

GRAMINACEÆ

Allied Starches:

While the official starch is a product from corn, hence called corn starch, it should be borne in mind that there are many plants that also yield starch, but each kind peculiar to itself. This should not be accepted to infer total physical and chemical difference, because these in the main are uniform. It is only in the shape of the starch granules as viewed under a microscope that we recognize a varying form,

FIG. 25.—Starch granules, magnified 475 diameters.

and that this is characteristic alone for the source whence derived. Thus, when given a starch or mixture of starches, a small portion moistened with water and viewed under high power readily reveals its origin by the various outline granules. In this way (from their contained starch) it is possible to distinguish many official roots, rhizomes, seeds, fruits, etc., as it is also the cereals, edible fruits, and vegetables.

I. *Wheat Starch* (*Agropy'ron* (*Trit'icum*) *æsti'vum*). U. S. P. 1880. Lenticular, large and small granules, layers indistinct, hilum slight, near the center.

II. *Potato Starch* (*Sola'num tubero'sum*). Ovate, granules unusually large, layers very distinct, hilum rather small and at the narrow end.

III. *Maranta Starch* (*Maran'ta arundina'cea*). Ovate granules, layers delicate, distinct, hilum at the broad end, often cleft.

IV. *Corn Starch* (*Ze'a Ma'ys*). Polyhedric granules, layers not easily distinguishable, hilum central, large.

V. *Oat Starch* (*Ave'na sati'va*). Polyhedric granules often united in ovoid masses (compound), layers and hilum indistinct.

VI. *Rice Starch* (*Ory'za sati'va*). Polyhedric granules, uniform, similar but much smaller than corn starch, hilum very small.

VII. *Bean Starch* (*Phase'olus vulga'ris*). Ellipsoidal granules, layers distinct, crossed by fissures radiating from center.

VIII. *Curcuma Starch* (*Cur'cuma lon'ga*, +). Elliptic granules, flat, contracted at one end; layers numerous, delicate, hilum small, at narrow end.

IX. *Tapioca. Brazilian Arrow-root* [*Man'ihot Manihot* (*utilis'sima*)]. *Cassava Starch.* Muller-shaped, layers indistinct, hilum near rounded end, often cleft.

X. *Sago. Pearl Sago* (*Metrox'ylon Rum'phii* and *M. Sa'gu*). Ovate granules, 1 end truncate, layers more or less distinct, hilum at rounded end, often cleft.

XI. *Sarsaparilla Starch* (*Smi'lax officina'lis*). Roundish, compound, usually with cleft hilum.

XII. *Euphorbia Starch* (*Euphorbiaceæ Plantæ*). Elongated, bone-shaped nodular ends, layers distinct.

Derivative Products:

1. **Glucosum. Glucose,** $C_6H_{12}O_6$, or hydrated, $C_6H_{12}O_6.H_2O$, *U.S.P.* —(Syn., Glucos., Liquid Glucose, Syrupy Glucose, Grape-sugar, Dextrose, Starch-sugar, Saccharum Amylaceum (Uveum); Fr. Sirop Cristal, Glucose Masse; Ger. Stärke-, Trauben-, Kartoffel-zucker, Glukose, Glykose.)

Manufacture: From grapes, decomposition of glucosides, but chiefly by the incomplete hydrolysis of starch—boil starch (100), water (400), sulphuric acid (.5–1.25) until iodine gives no starch reaction, neutralize (free acid) with chalk, clarify and decolorize liquid with clay and animal charcoal, filter, concentrate in vacuum-pan, when much calcium sulphate separates, filter, concentrate for glucose (liquid) or grape-sugar (crystals). It is a colorless, slightly colored, thick, syrupy liquid; odorless or nearly so; sweet taste; soluble in water, sparingly in alcohol; aqueous solution neutral, slightly acid; contains chiefly dextrose (*d*-glucose), $C_6H_{12}O_6$, 34–43 p. c., and dextrins, 30–45 p. c., maltose 0–19 p. c., water 14–23 p. c. *Tests:* 1. Add few drops of aqueous solution (1 in 20) to 5 cc. of hot alkaline cupric tartrate T. S.—copious red precipitate of cuprous oxide (dist. from sucrose).

GRAMINACEÆ

2. Incinerate—ash .5 p. c. *Impurities:* Heavy metals, arsenic, sucrose, water, free acid, starch, sulphur dioxide. Dose, *ad libitum.*

PREPARATIONS.—1. *Pilular Extracts of Belladonna, Conium, Hyoscyamus, Stramonium,* etc.

PROPERTIES AND USES.—Similar to cane-sugar (sucrose), nearly equal to it as a food; diuretic, dropsy, etc. One-half as sweet as cane-sugar; acts as a strong reducing agent in alkaline solutions; calcium sulphite often added as a preservative which accounts for it decolorizing free iodine. Crystals whitish, yellowish, brownish, soluble in water (1); contains dextrose 64–99.5 p. c., dextrin 0–22 p. c. Syrupus Glucosi (Br.)—liquid glucose (25) and syrup (50).

2. *Dextrinum Album, White Dextrin,* $C_6H_{10}O_5$, *N.F.*—A mixture of soluble carbohydrates: amylo-, achroo-, erythro-, malto-dextrin + unconverted starch, obtained by the incomplete hydrolysis of starch—heating it to 204° C. (400° F.) in a cylinder or flat vessel—commercial *British Gum,* or by the action of an acid—heating it 110° C. (230° F.) with diluted nitric acid. It is a white, glistening, non-hygroscopic, amorphous powder, harsh sensation when rubbed in the hand; odorless, sweetish taste, partly soluble in cold water, completely in boiling water (3). *Tests:* 1. Cold filtered aqueous solution, + iodine T. S.—wine-red; hot solution, + iodine T. S.—blue; solution, + alkaline cupric tartrate solution—no change, but reduced on boiling; ash .5 p. c. *Impurities:* Dextrose, metals, oxalic acid, natural gums, moisture: 1. *Pasta Dextrinata,* 33 p. c. + glycerin 33, water q. s. 100 Gm.; 2. *Stili Acidi Salicylici,* 35 p. c.

SUCROSUM. SUCROSE, *U.S.P.*

Saccharum officinarum, *Linné.* { A sugar, $C_{12}H_{22}O_{11}$, obtained from this plant and other sources.

Habitat. S. Asia, cultivated in tropics and subtropics, Africa, E. and W. Indies, Cuba, Brazil, S. United States, especially Louisiana.

Syn. Sucros., Saccharum, Sugar, Cane-sugar; Br. Saccharum Purificatum, Refined Sugar (Sucrose); Fr. Sucre Blanc officinal, Sucre de Canne, Sucre; Ger. Zucker, Rohrzucker, Weisserzucker.

Sac′cha-rum. L. sugar, Gr. *σάκχαρον,* fr. Ar. *sukkar.* Hung. *zukur,* ML. *succarum,* after *succus,* a juice, fr. Skt. *carkara,* candied sugar, orig. grit, gravel.

Of-fi-ci-na′rum. L. *officina,* workshop—*i. e., opus,* work, + *facere,* to do, = of or belonging to the shop or store.

Su-cro′sum. L., *sucrose,* Eng., fr. Fr. *sucre,* sugar, after *succus,* a juice—*i. e.,* from evaporating sweet juice.

PLANT.—Perennial herb; rhizome thick, jointed, solid; roots fibrous; stems many, 2–4.5 M. (6–15°) high, 2.5–5 Cm. (1–2′) thick, jointed, solid, containing white juicy pith, and, according to variety, outside yellow, greenish-yellow, purple, or striped, joints 7.5 Cm. (3′) apart, giving rise to encircling leaves; leaves 1–1.2 M. (3–4°) long, 5 Cm. (2′) wide, flat, acuminate, white, midrib, longitudinally striate, dentate;

flowers pinkish, in large terminal panicles. SUCROSE, in white, hard, dry crystals, blocks, or white, crystalline powder, odorless, sweet taste, permanent, soluble in water (.5), boiling water (.2), alcohol (170), insoluble in chloroform, ether; aqueous solution (1 in 20—syrup) neutral, dextrorotatory, sp. gr. 1.313; by ferments in air or by boiling with diluted acids syrup is converted into invert sugar (dextrose + levulose) which then is directly fermentable and reduces red cuprous oxide from alkaline solution of cupric oxide; kept for a time at 180° C. (356° F.) becomes converted into levulosane, $C_6H_{10}O_5$, and dextrose (glucose), $C_6H_{12}O_6$, without loss of weight. *Tests:* 1. Saturated solution in large, well-closed, completely filled bottle—deposits no sediment on prolonged standing (abs. of insoluble salts, ultramarine, Prussian blue). 2. Aqueous solution (1 in 1) viewed horizontally through vertical glass cylinder of 25 Mm. (1′) diameter—colorless, faintly yellow; incinerate—ash .05 p. c.

ADULTERATIONS.—Inferior sugars whitened with ultramarine or Prussian blue, insoluble salts, calcium, chloride, sulphate.

Commercial.—Plants of the sugar cane (there being several varieties) all resemble more or less our Indian corn, produce shoots readily, and are cultivated by cuttings planted in rows, while those of the sugar beet are practically acaulescent, biennial, and grown directly by planting the seeds annually under careful tillage, in rich soil. Cane-sugar was used by the ancients only as a medicine, being brought first from India to Europe by the Venetians during the Crusades; with the discovery of Cape of Good Hope and sea route to E. Indies the Portuguese secured its commercial control, after which cultivation extended to Arabia, Egypt, Sicily, Spain, Canaries, America, W. Indies (1494). It is obtained by cutting off ripe cane stems near the ground and passing them through iron rollers, thereby expressing the grayish, turbid, sweet juice, which is run into shallow copper pans and boiled with lime (1 in 800) to neutralize free acid and to clarify (by coagulating albumen and gluten—removed by occasional skimming), and, when sufficiently concentrated, tenacious and granular, transferring to coolers, where it is stirred frequently, thence to casks with perforated bottoms, where it is drained 24 hours and then strongly agitated with wooden stirrers, causing granulation in 6 hours, thus yielding yellowish *raw, open pan, muscovado sugar*, which is packed into hogsheads and exported, the drainings being known as treacle or molasses.

FIG. 26.—*Saccharum officinarum.*

GRAMINACEÆ

It is refined by dissolving in water with steam, heating with bullock's blood, skimming, filtering through canvas bags, percolating through large cylinders of animal charcoal, evaporating the colorless percolate in steam vacuum pans (to reduce pressure and heat) at 77° C. (170° F.), and, when sufficiently concentrated, running off the product into conical molds (centrifugals) having orifices closed, from which, after solidification, stoppers are removed for draining (treacle), loaves sugared by pouring over them saturated syrup, which by slow infiltration passes through carrying with it all coloring matter and impurities, without dissolving any crystallized sugar, thus yielding whitish *refined, vacuum pan, loaf sugar*. Sugar may also be obtained from beet, maple, birch, palm, etc.

Constituents.—Juice 80 p. c., which contains sucrose 16–21 p. c., water 78–84 p. c., mucilage, resin, fat, albumin .3–.4 p. c.

Preparations.—1. *Syrupus*. Syrup. (Syn., Sirup, Simple Syrup, Syrupus (Simplex) Sacchari; Fr. Sirop (de Sucre) simple; Ger. Syrupus simplex, Weisser Sirup.)

Manufacture: Dissolve sucrose 85 Gm., by cold percolation, or by heat, in distilled water 45 cc., heat to boiling point, strain, add through strainer distilled water q. s. 100 cc., mix thoroughly; should have sp. gr. 1.313, and contain 64.54 p. c., by weight, of sucrose. Dose, *ad libitum*.

Preps.: 1. *Compound or Medicated Syrups, Elixirs, Emulsions, Mixtures*, as well as an ingredient of other preparations. 2. *Liquor Magnesii Citratis*, 17 p. c.

2. *Ferri Carbonas Saccharatus*, 70 p. c. 3. *Massa Ferri Carbonatis*, 25 p. c. 4. *Pilulæ Ferri Carbonatis*, $\frac{3}{5}$ gr. (.04 Gm.). 5. *Pulvis Cretæ Compositus*, 50 p. c. 6. *Pulvis Glycyrrhizæ Compositus*, 50 p. c. 7. *Pilulæ Ferri Iodide, N.F.*, $\frac{3}{5}$ gr. (.04 Gm.). 8. *Confections, Elixirs, Mixtures, Powders, Solutions, Syrups, Tablets, Troches*, etc.—of various kinds.

Properties.—Demulcent, lenitive, stimulant, laxative, aliment, condiment, externally in certain ulcerations.

Uses.—Chiefly as vehicle, corrigent, preservative, antiseptic, excipient. Syrups protect ingredients against putrefaction, not always against fermentation, prevent iron preparations from oxidation; in troches, powders and mixtures covers taste of nauseous medicines, rendering insoluble substances more miscible with water; in food nutrient to adipose tissue, and a respiratory fuel; diuretic on healthy kidneys, has no effect on the teeth, good in cough, hoarseness, hiccough, aphthæ, ulcers, wounds, corneal and eyelid granulation, chronic laryngitis, chronic ozena (as snuff), ascarides (by injection), fumes destroy offensive effluvia.

Allied Products:

1. *Fructose, Fruit-sugar* (*Levulose*) $C_6H_{12}O_6$.—This often accompanies grape-sugar in fruits, honey, etc., sometimes in plants with cane-sugar. It is usually a colorless uncrystallizable syrup, nearly as sweet

as cane-sugar, levorotatory, soluble in water. May be produced from inulin by diluted acids; with nascent hydrogen yields mannite, with nitric acid is oxidized into succinic, acetic, and oxalic acids.

2. *Inosite, Phaseo-mannite,* $C_6H_{12}O_6.2H_2O$.—Found in juices of some meats, green fruits (Leguminosæ), asparagus, etc.; it is very sweet, crystallizes from water, alcohol; does not ferment, but with nitric acid yields explosive compounds and oxalic acid.

3. *Syrupus Fuscus, Molasses* (*Melasses*), U. S. P. 1860–1870. Have two kinds: 1, W. India; black, ropy, peculiar odor, sweet, empyreumatic taste; yields by fermenting and distilling commercial rum, and is the kind once official; 2, Sugar House (Golden Drips, Grocer's Syrup); same as preceding, only thicker, different flavor, often largely adulterated with glucose, sp. gr. 1.40, contains solid matter 75 p. c. Both kinds have uncrystallizable sugar with some cane-sugar which failed to crystallize out; also have gum, coloring matter. If these be boiled with a strong solution of potassium dichromate, get violent reaction, green liquid; but if adulterated with one-eighth starch-sugar molasses, the reaction is wanting, color not changed.

Derivative Products:

1. *Rock Candy, Saccharum Crystallizatum.*—Heat concentrated cane-sugar syrup, add spirit, and upon cooling, white, transparent, oblique, 4-sided prisms form; this is the purest kind of sucrose and makes most excellent official syrup.

2. *Barley-sugar, Saccharum Hordeatum.*—Cane-sugar melted carefully (185° C.; 365° F.) and suddenly cooled; it is amorphous, yellowish, transparent, gradually becoming crystalline and opaque externally.

3. *Caramel, Saccharum Ustum, Burnt Sugar Coloring,* $C_{12}H_{18}O_9$, *N.F.*—A concentrated aqueous solution of the product obtained by heating glucose (sugar) until sweetness destroyed and a uniform dark brown mass results, a small amount of alkali or alkali carbonate being added while heating. It is a thick, dark brown liquid, characteristic odor of burnt sugar, pleasant bitter taste; soluble in diluted alcohol, but on increasing to 80 p. c.—precipitates; insoluble in ether, chloroform, acetone, benzene, petroleum benzin, oil of turpentine; mixes with water in all proportions—1 in 1000—sepia tint, clear; no change or precipitate from 6 hours of sunlight, sp. gr. 1.350; contains colorless bitter caramelan $C_{12}H_{18}O_9$, saccharane, $C_{12}H_{22}O_{11}.2H_2O$ (chief coloring principle), red-brown caramelene, and other compounds. *Tests:* 1. Aqueous solution (1 in 20), + .5 cc. of phosphoric acid—no precipitate; incinerated—swells, forming cake-like charcoal—ash 8 p. c. Used in coloring liquid preparations; 1. *Elixir Pepsini et Bismuthi;* 2. *Elixir Vanillini Compositum;* 3. *Tinctura Antimonii;* 4. *Tinctura Opii et Gambir;* 5. *Tinctura Persionis Composita.*

Allied Plants:

1. *Ave'na sati'va, Oat, N.F.*—The grain with not more than 5 p. c. of other seeds or of foreign organic matter; Asia, Europe. Plant .6–1.3 M. (2–4°) high, culm smooth, leaves linear, veined, rough, panicles

GRAMINACEÆ

loose, spikelets 2–3-flowered, paleæ (husk) cartilaginous. Grain pale yellow, up to 1.5 Cm. ($\frac{3}{5}'$) long, 3 Mm. ($\frac{1}{8}'$) thick, fusiform, scar at base, apex showing lemma and palet, groove on ventral side having 2-veined palet or scale, straight or slightly twisted awn (strongly twisted —*Wild Oat*), caruncle at micropylar end, dense hairs at apex; odor slight; taste starchy. Powder, whitish—epicarp, pointed hairs, fragments of lemma and palet, coarse unicellular hairs, endosperm, starch grains up to .06 Mm. ($\frac{1}{400}'$) broad, polygonal or fusiform individual grains up to .01 Mm. ($\frac{1}{2500}'$) broad. Grain composed of husk 25 p. c., grain (kernel) 75 p. c.; the former contains fixed oil 1–1.5 p. c., sugar and gum .25–.75 p. c., proteins 2 p. c.; the latter starch 64–66 p. c., fat 5–7 p. c., proteins 18–21 p. c. (mainly avenin), salts 1–3 p. c. The grains when ground yield—oatmeal, when deprived of paleæ—groats.

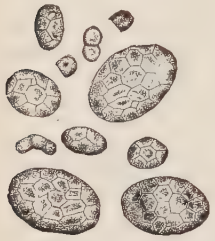


FIG. 27.—Oat starch: magnified 250 diam.

Oatmeal (*Farina Avenæ*) is not uniform, but is yellowish-white, with gluten and husk present, bitterish, starch granules polyhedric, muller-shaped. Demulcent, laxative, dietetic, nutritive; indigestible husks act as a mechanical irritant, exciting peristalsis, but may constipate by compaction; porridge or gruel may ferment and impair digestion. Dose, *ad libitum;* 1. *Fluidextractum Avenæ Sativæ* (33 p. c. alcohol), dose, ʒj–2 (4–8 cc.). Prep.: 1. *Elixir Hydrastis Compositum*, 1.75 p. c.

2. *Andropo'gon squarro'sa* (*murica'tus*), *Vetiveria* (*Vetivert*).—E. India. The fibrous wiry roots from the rhizome; yellowish-brown, waxy, 15–20 Cm. (6–8′) long, 1 Mm. ($\frac{1}{25}'$) thick, tough, aromatic, balsamic; contains volatile oil, resin. Used as tonic, stimulant, in perfumery, sachet powders (violet), etc.

3. *Sor'ghum vulga're*, *Broom Corn.*—Fruit 4 Mm. ($\frac{1}{6}'$) long, oval, flattened, brownish-yellow. Used in decoction (10 p. c.) for cystitis, etc.

MALTUM. MALT, *U.S.P.*

Hordeum vulgare, *Linné.* { The grain of one or more varieties, partially germinated artificially, and containing amylolytic enzymes.

Habitat. W. Asia, China, Egypt; cultivated.

Syn. Hordeum Decorticatum (Perlatum), Maltum Hordei, Barley Malt; Fr. Orge Perlé, Malt d'Orge, Dreche; Ger. Perlgerste, Perlgraupen, Malz, Gerstenmalz.

Hor'de-um. L. barley, classical Latin name, fr. *horrere*, bristle—*i. e.*, spikelets pointed with an awn, or of the bristle form.

Vul-ga're. L. *vulgaris*, common, ordinary—*i. e.*, kind growing wild and in general use.

PLANT.—Annual grain, culm, .6–1 M. (2–3°) high, leaves 15–37.5 Cm. (6–15′) long, linear, scabrous, spike 7.5–10 Cm. (3–4′) long, fruit

in 2 rows, seed elliptical, 8 Mm. ($\frac{1}{3}'$) long, flat back, angled sides grooved front, smooth, grayish-yellow from adherent paleæ, when removed brownish; deprived of outer integuments (pericarp) gives "pot barley," and by partial grinding get "pearl barley," having the integuments and a portion of the kernel removed, and ends of seed rounded off, producing grains 2.5–4 Mm. ($\frac{1}{10}$–$\frac{1}{6}'$) long, and about as broad; contains starch 60–68 p. c., protein compounds (gluten, albumin) 12–16 p. c., oil 2–3 p. c., cellulose 8–12 p. c. MALT, in yellowish, amber-colored grains, crisp when fractured, interior nearly white, agreeable, characteristic odor, sweet taste, due to conversion of the starch in the seed to maltose through the action of diastase, floats in cold water; capable of converting 5 times its weight of starch into sugars. *Tests:* 1. The solid soluble constituents from evaporating aqueous infusion (5 p. c.) to dryness should be 70 p. c. of the malt taken. 2. The acidity of malt, calculated as lactic acid, should not exceed .3 p. c. *Solvent:* cold water dissolves about 70 p. c. Dose, *ad libitum.*

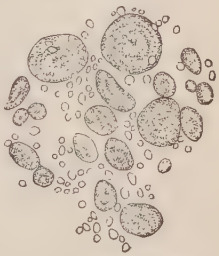


FIG. 28.—Barley starch

Commercial.—Barley seed are soaked in water, placed in heaps, when heat is generated spontaneously, being prevented from rising too high by occasional turning; germination takes place, and when the germ (acrospire) has acquired the proper length ($\frac{1}{3}$ of grain), the grain is dried rapidly to kill the embryo, thereby arresting further action of diastase, hence conversion of starch to maltose, sprouts removed, and thus constitutes malt. According to degree of heat used in drying will be obtained the pale, pale-amber, or amber-brown varieties; the grain increases 9 p. c. in size, but loses 20 p. c. in weight, becoming soft and easily crumbled.

CONSTITUENTS.—Diastase .2–1 p. c., peptase (converts albumin into peptones and para-peptones), hordenine, dextrose, sugar, starch.

Diastasum, Diastase.—A mixture containing amylolytic enzymes from an infusion of malt; it is a yellowish-white amorphous powder, odorless, tasteless; converts starch into dextrin and maltose, and 50 times its weight of potato starch into sugars—power diminished by age, heat and acid or alkaline media. *Taka-Diastase* is a kindred ferment, claimed to convert 100 times its weight of starch into sugar (glucose) within 10 minutes. Dose, gr. 5–8 (.3–.5 Gm.), alone or with pepsin, usually just after meals.

PREPARATION.—1. *Extractum Malti.* Extract of Malt. (Syn., Ext. Malt.; Fr. Extrait (Essence) de Malt; Ger. Malzextrakt.)

Manufacture: Infuse malt with water at 60° C. (140° F.), concentrate at same temperature, add 10 p. c., by weight, of glycerin; sp. gr. 1.350–1.430—consistency of thick honey; yield 65–75 p. c. It is a sweet, viscous, light brown liquid extract, with agreeable characteristic odor, acid reaction, soluble in water, turbid, then flocculent precipitate

with alcohol, tannin, alkaloidal reagents, mercuric chloride, gradually liquefies starch-paste, which will not become blue with iodine; contains water 20–25 p. c., maltose 48–70 p. c., dextrin 2–16 p. c., glucose, diastase 1–2 p. c., proteins 8 p. c., phosphoric acid .3–.4 p. c., lactic acid .75–1.5 p. c., ash 1.5 p. c.; converts not less than 5 times its weight of starch into water-soluble sugars. Should be kept cool, in well-closed containers. Dose, ʒj–4 (4–15 Gm.).

Properties and Uses.—Barley: As a nutritive in bronchial affections, sore throat, febrile diseases, pulmonary and urinary disorders; Malt: Yields to cold water its active constituents (diastase .2–1 p. c., dextrin, sugar, starch, etc.), producing an infusion or wort which by adding hop and fermenting gives several kinds of malted liquors (ale, porter, lager beer, brown stout, etc.)—infusion may be used in wasting diseases, cholera infantum, diarrhea; Extract: Good for dyspepsia, phthisis, wasting diseases, as an emulsifying agent, as a basis for cod-liver oil emulsion; dry extract as food for infants.

Allied Plants:

1. *Agropy'ron re'pens, Triticum, Couch Grass, Dog Grass, N.F.*—The dried rhizome and roots with not more than 2 p. c. of foreign organic matter, yielding not more than 3 p. c. of acid-insoluble ash; Europe, N. America. Perennial weedy grass (farmer's pest); culm .6–1.2 M. (2–4°) high; spikes resemble wheat, spikelets 3–8-flowered, 2-ranked glumes shortened or acute. Rhizome, usually in pieces 4–12 Mm. ($\frac{1}{6}$–$\frac{1}{2}'$) long, 1–2.5 Mm. ($\frac{1}{25}$–$\frac{1}{10}'$) thick, yellowish, furrowed, smooth, lustrous, nodes, leaf-, and root-scars; fracture tough, fibrous, hollow pith; roots filiform, brownish root hairs; odor slight, aromatic; taste sweetish. Powder, light yellowish—tracheæ, pores, sclerenchymatous fibers, epidermal cells separated by a narrow cell, parenchyma; solvent: water; contains triticin 8 p. c., fruit sugar 2.5–3.5 p. c., inosite, glucose, mucilage, malates, ash 2–3 p. c. Diuretic, aperient, demulcent, vulnerary; cystitis, irritable bladder, dysuria, gravel, fevers, jaundice, bronchitis, gout. Dose, ʒss–3 (2–12 Gm.); 1. *Fluidextractum Tritici* (water—when finished add one-fifth vol. of alcohol, as preservative); 2. *Elixir Sabal et Santali Compositum,* 26 p. c., + triticum 26. *Decoction* (Br.) 5 p. c.; *Infusion,* 5 p. c.

Fig. 29.—*Agropyron repens.*

2. *Sere'noa serrula'ta, Saw Palmetto Berries, N. F.*—Palmaceæ. The partially dried, ripe fruit with not more than 1 p. c. of foreign organic matter; should contain 10–15 p. c. of its natural moisture when used for pharmaceutical preparations; S. United States—near seacoast. Small, stout, evergreen shrub, large underground trunk; leaves orbic-

ular, .6–1 M. (2–3°) long, .3–.6 M. (1–2°) broad, 10–12-cleft, petioles aculate-serrate. Fruit, 1-seeded drupe, similar to olive, ovoid, 1.5–3 Cm. ($\frac{3}{5}$–$1\frac{1}{5}'$) long, 1–1.5 Cm. ($\frac{2}{5}$–$\frac{3}{5}'$) broad, bluish-black, smooth, oily, shriveled from contraction of sarcocarp; epicarp and sarcocarp forming thin coriaceous shell enclosing thin reddish-brown endocarp which encloses an ovoid, reddish-brown seed; odor pronounced, aromatic; taste sweetish, aromatic, acrid. Powder, yellowish-brown—parenchyma cells of sarcocarp, yellowish amorphous substance, endosperm,

FIG. 30.—*Agropyron repens:* rhizome and transverse section, magnified 3 diam.

large pores, stone cells: solvent: 80 p. c. alcohol; contains volatile oil .5–1 p. c., fixed oil 10–15 p. c., fat, alkaloid, resin, dextrin, glucose; seed—fixed oil 12 p. c. Sedative, diuretic, expectorant, tonic, anticatarrhal; chronic bronchitis, phthisis, inflammation of genito-urinary tract, nose, larynx, atonic impotence. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Sabal* (80 p. c. alcohol), dose, ♏xv–60 (1–4 cc.); 2. *Elixir Sabal et Santali Compositum*, 26 p. c. + triticum 26, fldext. zea 26, fldext. sandalwood 6.5; 3. *Tinctura Sabal et Santali*, 20 p. c. + sandalwood 6.5 (80 p. c. alcohol), dose, ℥j–2 (4–8 cc.). Inhalation—mix alcoholic solution with boiling water—inhale vapor.

3. *Metrox'ylon Rum'phii* (*Sa'gus Rum'phii*), *Pearl Sago.*—The prepared fecula, U. S. P. 1820–1870; E. India Islands, Borneo, Moluccas, etc. Medium-sized palm, 6–9 M. (20–30°) high, stem thick, covered with leaf-stalk remains, many pinnate leaves at apex; fruit round nut, covered with an imbricate coat, 1-seeded. The stem center contains medullary matter like elder pith, which is obtained by felling and splitting the tree trunk, washing pith to extract the starch, which may be powdered, forming sago meal, or granulated. Each tree yields 500–600 pounds (225–270 Kg.) of sago. Pearl sago is the best, in pearl-like grains, brownish, diaphanous, unaltered granules oblong, truncate, muller-shaped, layers, distinct, hilum at rounded end often cleft; common sago (*M. Sa'gu*) is larger grained. Used as demulcent, nutrient for sick with weak digestion, fevers; it is easily digested, non-irritating, prepared by boiling 1 part in water 32, straining, flavoring. Factitious sago is made from potato starch.

FIG. 31.—Saw Palmetto; fruit and seed.

GRAMINACEÆ

4. *Dæmon'orops* (*Cal'amus*) *Dra'co, Draconis Resina* (*Dragon's Blood*).—Borneo, Sumatra. A spontaneous resinous exudation from the ripening fruit; occurs in tears, globular pieces 4 Cm. ($1\frac{3}{5}'$) thick, cylindrical sticks .3 M. (12′) long, or in irregular cakes, dark brown, inside bright red, fracture dull, irregular, inodorous; when heated aromatic like benzoin, tasteless; contains red resin (draconin), benzoic acid or cinnamic acid, or both wanting, dracoresinotannol, dracoresin, dracoalban, ash 8–9 p. c. Mild stimulant, astringent. Used in tooth powders, plasters, varnishes.

Fig. 32.—*Metroxylon Rumphii.*

Fig. 33.—Sago starch.

5. *Ar'eca Cat'echu, Areca Nut.*—East Indies; cultivated. Large palm tree 15–18 M. (50–60°) high, fruit orange-color, size of hen's egg, contains 1 seed (nut), roundish, conical, 25 Mm. (1′) long, 9 Mm. ($\frac{3}{8}'$) thick, brown, with many reddish veins, inside horny, white, odor faint, taste astringent; contains fat 14 p. c., tannin, resin, arecoline, $C_8H_{13}O_2N$ (poisonous, tænifuge), arecaine, guvacine; astringent, tænifuge. Dose, ʒij–3 (8–12 Gm.).

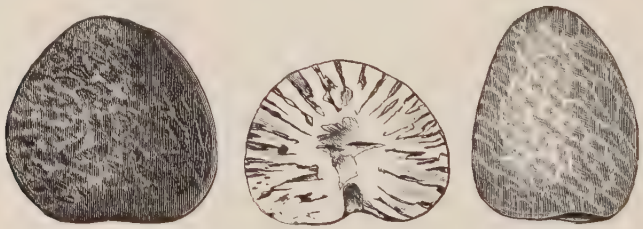


Fig. 34.—*Areca Catechu.*

6. *Elæ'is guineen'sis, Oleum Palmæ* (*Palm Oil*).—W. Africa. Heat fruit with water and express. It is a solid fat, harder than butter, orange-red, bleached by light and heat, violet odor, bland taste, fuses at 27° C. (81° F.), upon keeping acquires rancid odor and lighter color; demulcent; used in ointments, but mostly in soaps and candles.

7. *Co'cos nucif'era, Oleum Cocois (Cocoanut Oil).*—Tropics. A fixed oil expressed from palm seeds after being boiled with water; yield 50–60 p. c.; it is a white solid, consistence of butter, odor disagreeable, soon becoming rancid; demulcent; mostly used in soaps.

8. *Arisæ'ma (A'rum) triphyl'lum, Indian Turnip.*—The cormus, U. S. P. 1820–1860; N. America. Plant acaulescent, leaves 2, 3-divided, 5–17.5 Cm. (2 7′) long, 2.5–7.5 Cm. (1–3′) wide. Corm 2.5–5 Cm. (1–2′) broad, brownish-gray, inside white, mealy, taste burning, acrid: contains volatile acrid principle, starch, fat, gum, resin, calcium oxalate (gives acridity). Stimulant, expectorant, diaphoretic; irritant; colic, flatulence, asthma, whooping cough, chronic catarrh, rheumatism, bronchitis, aphthous sores, ringworm; in honey, syrup, ointment. Dose, gr. 5–15 (.3–1 Gm.).

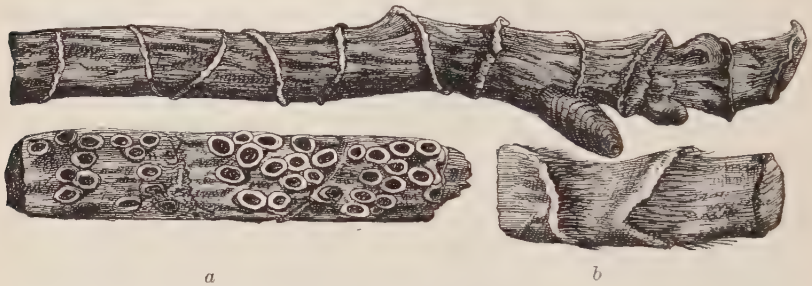
Fig. 35.—*Acorus Calamus.*

9. *Spathye'ma (Symplocar'pus) fœ'tida, Skunk Cabbage.*—The dried rhizome and roots, U. S. P. 1820–1870. Perennial, spathe appears first in spring, covered with purplish spots and stripes, flowers dull purple, leaves .3–.6 M. (1–2°) long, .3–.4 M. (12–15′) wide. Rhizome obconical, truncate, 7.5–10 Cm. (3–4′) long, 5 Cm. (2′) thick. Many rootlets, brownish-gray, inside whitish, many wood-bundles, whole plant fetid, more so when triturated, taste acrid, biting; contains volatile oil, gum, fat, resin, starch. Emetic, diuretic, antispasmodic, stimulant, narcotic; asthma, chronic catarrh, rheumatism, chorea, hysteria, dropsy, bronchitis, in infusion, tincture. Dose, gr. 5–15 (.3–1 Gm.).

10. *Ac'orus Cal'amus, Calamus Root, Sweet Flag.*—Araceæ. The unpeeled, dried rhizome, U. S. P. 1820–1900; N. America, Europe, Asia, swamps. Perennial herb; leaves, like those of *Iris versicolor*, 1–1.3 M. (3–4°) long, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}$′) wide, equitant, sharp-pointed, sharp-edged; flowers on scape, spadix (spike) 5–10 Cm. (2–4′) long,

MELANTHACEÆ

1 Cm. ($\frac{2}{5}'$) thick, minute, greenish-yellow. Rhizome, .6–1 M. (2–3°) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}'$) thick, entire or longitudinally split pieces, cylindraceous, yellowish-brown, wrinkled, annulate (remnants of leaf-sheaths), leaf-scars above, pitted root-scars beneath, fracture short, sharp, corky, spongy, whitish, showing oil cells; odor aromatic; taste



a *b*

FIG. 36.—*Acorus Calamus*, rhizome: *a*, under surface; *b*, upper surface.

pungent, bitter; solvents: alcohol, hot water partially; contains (most in cortex) volatile oil 1.5–3.5 p. c., acorin .2 p. c., choline (calamine), resin. Stimulant, carminative, tonic, bitter, aromatic; dyspepsia, colic, flatulency, coughs, flavoring. Dose, gr. 15–60 (1–4 Gm.); fluid-extract (75 p. c. alcohol), ℥xv–60 (1–4 cc.; tincture 20 p. c., ʒj–2 (4–8 cc.); infusion.

11. *Epiprem'num mirab'ile* (*Rhaphidoph'ora vitien'sis*—Araceæ), and *Prem'na traiten'sis*, *Tonga*.—Verbenaceæ; Fiji Islands. The mixed bark contains tongine (volatile alkaloid), volatile oil. Anodyne; neuralgia, rheumatism, in combination with salicylates. Dose, gr. 15–60 (1–4 Gm.).

7. MELANTHACEÆ. Bunch-flower Family.

Me-lan-tha'se-e. L. *Melanth-ium* + aceæ, fr. Gr. μέλας, black, + ἄνθος, flower—*i. e.*, alluding to the darker color which the persistent perianth assumes after blossoming. Leafy-stemmed herbs. Distinguished by being rarely bulbous; leaves grass-like, parallel-veined with transverse veinlets; perianth 6, stamens 6, ovary 3-celled, superior; fruit capsule, septicidal; seeds tailed or appendaged; temperate climates; sedative, diaphoretic, sternutatory, poisonous.

Genus: **1. Veratrum.**

VERATRUM VIRIDE. VERATRUM VIRIDE, *U.S.P.*

Veratrum viride, *Aiton.* { The dried rhizome and roots, with not more than 5 p. c. stems or other foreign organic matter, yielding not more than 4 p. c. acid-insoluble ash.

Habitat. N. America, Canada to Georgia, in rich, wet woods, swamps.

Syn. Verât. Vir., Green Hellebore, American Hellebore, American White Hellebore, Swamp or False Veratrum (Hellebore), Devil's Bite, Duckretter, Bugbane, Bugwort, Earth Gall, Indian Poke (their ordeal poison). Tickle (Itch) Weed (to bare-legged boys); Veratri Viridis Rhizoma; Fr. Vératre vert; Ger. Grüner Germer.

Ve-ra'trum. L. *vere,* truly, + *ater,* black, dark—*i. e.,* the color of the roots of some species.

Vir'i-de. L. *viridis,* green—*i. e.,* flowers are greenish.

PLANT.—Large, luxuriant, perennial herb; stem annual .6–2 M. (2–7°) high, stout, cylindrical, solid, nearly smooth, pale green, unbranched except in the inflorescence; leaves 12.5–20 Cm. (5–8′) long, oblong, acuminate, sheathing the stem, plaited, nerved, pubescent; flowers May–July, many polygamous, nearly sessile, greenish-yellow, racemes with downy peduncles, sepals petaloid; fruit of 3 nearly distinct follicles 2.5 Cm. (1′) long, pericarp dry, brown, ventral dehiscence; seed flat, about 12 in each carpel. RHIZOME, upright, obconical, usually cut longitudinally into 2–4 pieces, 2–7 Cm. ($\frac{4}{5}$–3′) long, 1.5–3 Cm. ($\frac{3}{5}$–1$\frac{1}{5}$′) thick, brownish, frequently numerous thin leaf-bases closely arranged at the summit, otherwise rough, wrinkled, somewhat annulate from scars of bud-scales; inodorous; taste bitter, acrid. Roots numerous, nearly cylindrical, 3–8 Cm. (1$\frac{1}{5}$–3′) long, 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, usually brittle, whitish, more or less starchy. POWDER, grayish-brown—strongly sternutatory, numerous starch grains .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, raphides of calcium oxalate, tracheæ scalariform or reticulate, often with lemon-yellow contents, lignified porous fibers; few reddish-brown cork fragments. *Solvent:* alcohol. Dose, gr. 1–4 (.06–.26 Gm.).

ADULTERATIONS.—Rhizome of allied plants, also those of *Spathyema* (*Symplocarpus*) *fœtida.*

Commercial.—Rhizome is collected chiefly in autumn, sometimes just before flowering, washed, dried, entire or sliced, and, owing to likely deterioration, should not be kept more than a year. Fresh leaves in contact with the skin often produce itching, and when carelessly gathered and cooked, as spinach, in place of marsh marigold (cowslip—*Cal'tha palus'tris*), cause very serious results.

CONSTITUENTS.—Protoveratrine .03 p. c., Jervine .1 p. c., Rubijervine .005 p. c., Pseudojervine, Protoveratridine (decomposition product), Cevadine, veratramarin (bitter glucoside), jervic acid, fat, resin, gum, starch; veratroidine no longer considered an alkaloid, but a mixture of amorphous bases.

Protoveratrine, $C_{32}H_{51}O_{11}N$.—Most important; white shining crystals, soluble in chloroform, hot alcohol; solution greenish with H_2SO_4, changing to blue, violet.

Jervine, $C_{26}H_{37}O_3N$.—Most abundant; white crystals, tasteless, non-sternutatory, slightly toxic, soluble in alcohol, acetone, chloroform.

Rubijervine, $C_{26}H_{43}O_2N.H_2O$. — White prisms, distinguished from jervine by the ready solubility of its nitrate and sulphate; almost inert.

MELANTHACEÆ

Pseudojervine, $C_{29}H_{43}O_7N$.—White crystals, soluble in alcohol; almost inert.

FIG. 37.—*Veratrum viride: a*, root; *b*, flower; *c*, ovary; *d*, plant at its early age.

PREPARATIONS.—1. *Tinctura Veratri Viridis.* Tincture of Veratrum Viride. (Syn., Tr. Verat. Vir., Tincture of Green (American) Hellebore; Fr. Teinture de Vératre vert; Ger. Grün Nieswurzeltinktur.)

Manufacture: 10 p. c. Moisten 10 Gm. with sufficient alcohol, transfer to percolator without pressing, let stand, well-covered, for 6 hours, pack firmly, add alcohol to saturate and cover, macerate for 24 hours, percolate with alcohol q. s. 100 cc. Dose, ♏ij–10 (.13–.6 cc.).

Unoff. Preps.: Extract, dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.). *Fluidextract*, dose, ♏j–4 (.06–.24 cc.). *Dr. Norwood's Tincture*, 50 p. c., saturated, being the same strength as the U. S. P. tincture of 1870, dose, ♏v–8 (.3–.5 cc.).

Properties.—Sedative, emetic, diaphoretic, irritant, sternutatory, errhine. This resembles aconite very closely in action, being a cardiac depressant and spinal paralyzant. It diminishes the frequency and force of cardiac contractions, by depressing heart muscle, and stimulating inhibition (vagus), lowers arterial and blood-pressure, depresses spinal cord, causing muscular relaxation, induces cutaneous relaxation, hence free sweating; large doses produce rapid but very feeble pulse, cold, clammy skin, vomiting, debility, giddiness, impaired vision, partial unconsciousness; it is eliminated by the bowels. Protoveratrine, the most active heart content, slows the pulse by its powerful stimulating influence upon the vagus nerve, while jervine, constituting more than one-half of the total alkaloids, plays an important part in lowering arterial tension by depressing powerfully the heart and vasomotor center; the so-called veratroidine depresses the cord, paralyzes respiration, and causes emetocatharsis, thereby often preventing fatal results.

Fig. 38.—*Veratrum album.*

Uses.—To reduce arterial excitement, spinal spasms, pneumonia, cardiac diseases, typhoid fever. Always given in the commencing or inflammatory stages, heart disease, nervous palpitation, puerperal and epileptiform convulsions, tetanus, chorea, mania-a-potu, diphtheria.

Poisoning, Incompatibles, Synergists: Same as for aconite.

Allied Plants:

1. *Veratrum al'bum, White Hellebore* (*Veratrum*).—The rhizome, U. S. P. 1820–1870; Europe—Alps, Pyrenees, Balkans. Plant nearly identical with the official, slight variations being due possibly to climate and soil; constituents same in character and name, except there is no cevadine; the veratralbine of former writers is no longer considered an alkaloid, but a mixture of amorphous bases. Properties and uses precisely as the official.

2. *Asagræ'a officina'lis, Sabadilla, Cevadilla; Veratrina, Veratrine, Veratria, N. F.*—A mixture of alkaloids obtained from the seed; Mexico. Bulbous perennial herb; bulb ovoid covered with black scales;

MELANTHACEÆ

scape 1.2–1.5 M. (4–5°) high; fruit 3-celled capsule (follicle). Seed 6 Mm. ($\frac{1}{4}'$) long, dark brown, fusiform; contains veratrine (cevadine, veratridine, cevadilline, sabadine, sabadinine), angelic acid, methyl-crotonic acid, cevadic acid, veratric acid, fixed oil, ash 3.5 p. c.

Veratrina. Veratrine, $C_{37}H_{53}O_{11}N$.—This mixture of alkaloids is obtained by exhausting seed with alcohol, evaporating to syrupy consistency, adding water to remove resin, oil, coloring matter, etc., precipitating the filtrate containing veratrine veratrate with ammonia water in excess; or may boil alcoholic extract in acidulated water (HCl or H_2SO_4), decompose with magnesium oxide, take up alkaloids with acidified alcohol, evaporate, filter through animal charcoal, precipitate with ammonia water. Commercial or medicinal veratrine usually consists of veratrine, cevadine (most important, sternutatory, with potassium hydroxide splitting into methyl-crotonic acid and amorphous cevine, $C_{27}H_{43}O_8N$), veratridine, cevadilline (amorphous, insoluble in ether, benzene), sabadine (non-sternutatory, crystallizes from ether in needles and, like the preceding alkaloids, is colored yellow, then red by sulphuric acid), sabadinine (resembles sabadine, but turns red at once with sulphuric acid), and their derivatives. It is a white, grayish-white, amorphous

FIG. 39.—*Asagræa officinalis:* *a*, fruit-bearing stem; *b*, root, bulb, and leaves.

a *b*

FIG. 40.—Sabadilla: *a*, fruit, natural size; *b*, seed and longitudinal section, magnified.

powder, odorless, but causing intense irritation and sneezing; slightly hygroscopic, soluble in water (1760), hot water (1345), alcohol (2.8), chloroform (.7), ether (4.2), insoluble in purified petroleum benzin; alcoholic solution alkaline; with sulphuric acid—yellow, orange-red, greenish fluorescence, intensified by sulphuric acid; alcoholic solution + platinic chloride T. S.—clear (abs. of foreign alkaloids). Sedative, powerful irritant, sternutatory, errhine, great depressant, reduces force and rate of pulse; externally—muscular and articular rheumatism, neuralgia, sciatica, headache, pneumonia. *Poisoning:* same as aconite. Must be cautious in handling it—never use on abraded surface, and should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{32}$–$\frac{1}{12}$ (.002–.005 Gm.—seldom given internally); 1. *Oleatum Veratrinæ,* 2 p. c.; 2. *Unguentum Veratrinæ,* 4 p. c.

3. *Chamæli'rium lu'teum, Helonias, False Unicorn, N. F.*—The dried rhizome and roots with not more than 5 p. c. of foreign organic matter; N. America. Fragrant perennial herb; stem .3–.7 M. (12–18′) high, from basal rosette of lanceolate leaves terminating in plume-like raceme—pistillate greenish, staminate creamy-white; fruit capsule. Rhizome .5–3 Cm. ($\frac{1}{5}$–$1\frac{1}{5}$′) long, 1 Cm. ($\frac{2}{5}$′) thick, roundish, grayish-brown, annulate from scars of bud-scales, leaf bases above, many yellowish wiry roots beneath, 5-8 Cm. (2–3′) long; fracture hard, horny, internally grayish-yellow, cortex 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}$′) thick, odor slight; taste bitter, astringent. Powder, yellowish—parenchyma cells with unaltered starch grains, bundles of calcium oxalate raphides, lignified cork and fibers, tracheæ; solvent: diluted alcohol; contains chamelirin (bitter saponin-like glucoside) 10 p. c. Tænifuge, diuretic, uterine tonic, emetic; tape-worm, atony of gastro-intestinal and genito-urinary mucous membranes, dropsy. Dose, ʒss–1 (2–4 Gm.); 1. *Fluid-extractum Heloniadis* (diluted alcohol). Preps.: 1. *Elixir Heloniadis Compositum*, 3.2 p. c. (fldext.), + fldext. of caulophyllum 3.2, fldext. of viburnum opulus 3.2, fldext. of mitchella 12.5, dose, ʒss–1 (2–4 cc.); 2. *Elixir Aletridis Compositum*, 6.5 p. c. Helonin ("Eclectic" extract), dose, gr. 1–5 (.06–.3 Gm.).

8. LILIACEÆ. Lily Family.

Lil-i-a'se-e. L. *Lili-um* + aceæ, a lily, fr. Celtic *li*, whiteness, alluding to beautiful white flowers of original species. Herbs, shrubs, trees. Distinguished by having bulbs, rhizomes, tubers, or fibrous roots; leaves parallel-veined; flowers regular symmetrical, 6-androus, perianth non-glumaceous, petaloid, free from 3-celled, superior ovary; anthers 2-celled; fruit many- or few-seeded pod or berry; temperate climates, tropics; purgatives, emetic, diuretic, diaphoretic, stimulant, astringent, acrid; fibers, food, condiment.

Genera: **1. Colchicum. 2. Aloe. 3. Urginea.**

COLCHICUM. COLCHICUM.

1. Colchici Cormus. Colchicum Corm, *U.S.P.*
2. Colchici Semen. Colchicum Seed, *U.S.P.*

Colchicum autumnale, *Linné.*

1. The dried corm, yielding not less than .35 p. c. of colchicine.
2. The dried ripe seed, yielding not less than .45 p. c. of colchicine.

Habitat. C. and S. Europe, N. Africa (England, Greece, Turkey, Switzerland); moist pastures and meadows.

Syn. Colch. Corm., Colchicum Root, Colch. Sem., Meadow Saffron, Naked Ladies, Autumn–, Fog–, Meadow–, Michaelmas–, or Purple-Crocus, Upstart,

LILIACEÆ

Bulbus (Tuber) Colchici; Colchici Radix; Colchici Semina; Fr. Colchique, Safran bâtard, Bulbe de Colchique—de Safran bâtard, Semences de Colchique; Ger. Semen Colchici, Zeitlosensamen, Herbstzeitlose, Wiesensafran, Zeitlosenknollen.

Col'chi-cum. L. fr. Gr. κολχίς, Colchis. An ancient province in Asia Minor, east of Black Sea, where this poisonous plant flourished; also the home of Medea, the sorceress and poisoner of ancient legend.

Au-tum-na'le.—L. *au(c)tumnalis*, belonging or peculiar to autumn—*i. e.*, the plant blooms Sept.-Oct., covering meadows with saffron-colored flowers resembling a carpet.

PLANT.—Bulbous perennial, several inches high; leaves radical, 3–5, sheathing 15–30 Cm. (6–12′) long, 2.5–5 Cm. (1–2′) wide, erect, entire, strap-shaped, smooth, shiny dark green; flowers 2–6, large, lilac-purple, resembling crocus except anthers extrorse; corolla-tube 12.5–15 Cm. (5–6′) long, two-thirds being underground; fruit of 3 inflated follicles, united at base, 4 Cm. ($1\frac{3}{5}$′) long, brown, papery, dehiscent; seed numerous. CORM, ovoid, convex on one side, flattish with a groove on the other, 25 Mm. (1′) long, 18 Mm. ($\frac{3}{4}$′) thick; epidermis thin, brownish, wrinkled; internally whitish, solid; usually in reniform, transverse or ovate longitudinal slices, 2–5 Mm. ($\frac{1}{12}$—$\frac{1}{5}$′) thick; flat surfaces whitish, slightly roughened, crystalline under hand lens; fracture short, mealy; odor slight; taste bitter, acrid. POWDER, grayish-brown—numerous starch grains, .003–.03 Mm. ($\frac{1}{8300}$—$\frac{1}{830}$′) broad, triangular, star-shaped central cleft, few tracheæ and fragments of epidermal cells. SEED, ovoid, irregularly globular, pointed at hilum, 2–3 Mm. ($\frac{1}{12}$—$\frac{1}{8}$′) broad, when fresh several seed cohering, brownish, finely pitted, tough, of bony hardness (by which they are distinguished readily from other seeds of similar appearance); internally whitish, mostly endosperm; nearly inodorous; taste bitter, acrid. POWDER, light brown—oil globules, aleurone grains, starch grains, .005–.02 Mm. ($\frac{1}{500}$—$\frac{1}{1250}$′) broad. *Solvents:* diluted alcohol; vinegar; wine. Dose, CORM, gr. 2–8 (.13–.5 Gm.); SEED, gr. 1–5 (.06–.3 Gm.).

FIG. 41.—*Colchicum autumnale:* 1, closed capsule; 2, open capsule; 3, styles; 4, cross-section of capsule; 5, seed.

Commercial.—Plant resembles our garden tulip, requiring 2 years for the cycle of complete development, but all parts have medicinal properties. Planting the bulb in the spring, by autumn a new cormus is formed on the lateral inferior portion, being still embraced half around by the parent whose place it is destined to take, sending roots downward and a spathe upward from which flowers emerge, Sept.–

Oct., but as yet no leaves; the lower corolla-tube, underground, whitish, perishes by Nov., while the fruit rudiment (ovary) remains underground until the following spring, when it rises on the stem in the shape of a 3-lobed, 3-celled capsule, bringing with it the first leaves. The corm is most active when a year old, and should be collected June–August of the second year, after seed are ripe and just before the sprouting forth of fall flowers from newly-forming cormus; it is then most developed and least exhausted from the formation of new bud

FIG. 42.—Colchicum corm (tuber): front and rear view; also transverse section.

and soon to be evolved corm, provided it be left in the ground. It now is dug, washed, sliced, and dried by sun or fire (65° C.; 150° F.), and resembles the tulip bulb, although without concentric scales; loses upon drying 70 p. c. The seed are the most concentrated portion of the plant and should be collected when fully ripe, July–August; their horny albumen renders powdering difficult, which is accomplished best in a mill with hardened plates; if pestle and mortar used, seed must be absolutely dry or be macerated in their menstruum to soften, so as to mash easily. Unless very fine, cold solvents extract only one-third of the colchicine, but hot solvents exhaust irrespective of fineness. England and Germany furnish our supply, the quality usually being determined simply by the degree of bitterness.

FIG. 43.—Colchicum seed: *a*, natural size; *b*, section magnified.

CONSTITUENTS.—Colchicine .5 p. c. (Colchiceine), Colchicoresin, Beta-colchicoresin, starch, sugar, fixed oil (seed—5–6 p. c.), gum, ash 2.6–8 p. c.

Colchicina, Colchicine, $C_{22}H_{25}O_6N$, *U.S.P.*—(Syn., Fr. Colchicine; Ger. Colchicin.). This alkaloid is prepared by exhausting seed with hot alcohol, recovering latter, adding water (to remove resin, fat, wax), shaking from brown filtrate with 4 portions chloroform, mixing these, distilling, dissolving residue in water, shaking with chloroform, evaporating last solution, thereby getting crude colchicine-chloroform; dissolve in alcohol, evaporate, treat with warm ether, crystallize, heat crystals with water, evaporate. It is in pale yellow, amorphous scales or powder, darker on exposure, odorless or nearly so; bitter taste; soluble in water (22), hot water (21), ether (220), benzene (100), alcohol, chloroform, insoluble in petroleum benzin; aqueous solution

(1 in 30) neutral, levorotatory, yellowish, intensified by inorganic acids; melts at 144° C. (291° F.). *Tests:* 1. Stir .001 Gm. with a few drops of sulphuric acid—lemon-yellow, changed by a drop of nitric acid to greenish-blue, red, yellow, + excess of sodium hydroxide T. S. —color changed to red. 2. Aqueous solution (1 in 100) 5 cc. + 2 drops of ferric chloride T. S.—no color (abs. of colchiceine); heat—brownish-red, then brownish-black. 3. Alcoholic solution (1 in 20) 1 cc., + a drop of ferric chloride T. S.—garnet-red; incinerate .1 Gm. —ash negligible. 4. Heat .01 Gm. + sodium hydroxide T. S. 2 cc. + a drop of aniline—no odor of phenyl-isocyanide (abs. of chloroform). This alkaloid and its salicylate are the best forms for use. Should be kept dark, in well-closed containers, and great caution must be used in tasting and handling. Dose, gr. $\frac{1}{160}$–$\frac{1}{120}$ (.0004–.0005 Gm.); 1. *Elixir Tongæ et Salicylicum, N.F.*, .0035 p. c.

Colchiceine, $C_{21}H_{23}O_6N.\frac{1}{2}H_2O$.—Not in drug, but produced as a result of hydrolysis in percolating with acid menstrua; readily converted into colchicine by etherification with methyl alcohol and hydrochloric acid, or with methyl iodide + sodium hydroxide in methyl alcohol; with mineral acids splits into acetic acid, methyl alcohol, and apocolchicine; it occurs in white crystals, non-toxic, inodorous, soluble in alcohol, chloroform, hot water, also in alkalies and their carbonates giving yellow solutions.

Colchicoresin, $C_{51}H_{60}O_{15}N_2$.—Brown, amorphous, soluble in chloroform, alcohol; insoluble in ether, sparingly in cold water.

Beta-colchicoresin, $C_{34}H_{39}O_{10}N$.—Blackish-brown, soluble in chloroform, strong alcohol; insoluble in water or ether. These last 2 are affected but slightly by tannin, are brownish-green by ferric chloride, and dissolve in potassium hydroxide with a brown color.

Preparations.—I. Corm: 1. *Extractum Colchici.* Extract of Colchicum. (Syn., Ext. Colch., Extractum Colchici Cormi, Powdered Extract of Colchicum, Extractum Colchici Radicis, Acetic Extract of Colchicum; Br. Extractum Colchici; Fr. Extrait de Colchique (acétique); Ger. Zeitlosen Essigextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted (200 cc.), reclaim alcohol until residue is 15 cc., rinse still with a little warm alcohol, which add to residue in a flask, cool, shake thoroughly with purified petroleum benzin 25 cc., again with 15 cc., again with 10 cc., discard benzin layers, transfer residue to dish, rinse flask with a little warm alcohol, which add to dish, evaporate to a thick extract, add dried starch 5 Gm., mix thoroughly, spread on glass plates, dry in current of warm air at 70° C. (158° F.), pulverize; after assay add enough dried starch for extract to contain 1.4 p. c. of colchicine; mix thoroughly, pass through fine sieve; contains 1.25–1.55—1.4 p. c. of colchicine; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

2. *Fluidextractum Colchici Cormi, N.F.* (67 p. c. alcohol)—100 cc. yields .31–.39—.35 Gm. of colchicine. Dose, ♏ij–8 (.13–.5 cc.).

3. *Tinctura Colchici Cormi Fortis, N.F.*, 40 p. c. (33 p. c. alcohol)—100 cc. yields .126–.154—.140 Gm. of colchicine; used instead of the wine. Dose, ♏x–30 (.6–2 cc.).

II. Seed: 1. *Fluidextractum Colchici.* Fluidextract of Colchicum. (Syn., Fldext. Colch., Fluidextractum Colchici Seminis, Fluid Extract of Colchicum Seed; Fr. Extrait fluide de Semence de Colchique; Ger. Zeitlosensamenfluidextrakt.)

Manufacture: Pack, percolate 100 Gm. with purified petroleum benzin until no greasy stain on filter paper, reject benzin solution; dry in air, add 67 p. c. alcohol to moisten, macerate in tightly-covered container 6 hours, repack, add menstruum, when begins to drop from lower orifice, close, macerate 48 hours, percolate until exhausted; reserve first 85 cc., reclaim alcohol from remainder at 60° C. (140° F.), concentrate residue to soft extract; dissolve this in the reserve, assay and add enough menstruum for the 100 cc. to contain .36–.44—.4 Gm. of colchicine. Dose, ♏j–5 (.06–.3 cc.).

2. *Tinctura Colchici.* Tincture of Colchicum. (Syn., Tr. Colch., Tinctura Colchici Seminis; Fr. Teinture (de Semences) de Colchique; Ger. Tinctura Colchici; Zeitlosentinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104, 60 p. c. alcohol—percolate 95 cc., assay and add q. s. menstruum for 100 cc. to contain .036–.044—.04 Gm. of colchicine. Dose, ♏x–30 (.6–2 cc.).

Properties.—Alterative, cathartic, emetic, sedative, diuretic, diaphoretic, gastro-intestinal irritant. Small doses increase secretions generally (urine, sweat, etc.); normal doses produce only pains and loose bowels, having little or no effect on nervous system, circulation, respiration, or temperature.

Uses.—Gout, rheumatism, especially if neuralgic, increases urea and uric acid elimination from blood, prurigo, urticaria, other gouty cutaneous troubles. Should be given with an alkali, pushing it just short of nausea, and before beginning with it the bowels should be moved with magnesium sulphate, oxide, or carbonate. Repeated attacks render larger doses necessary, and it may lose entirely its effect. Colchicum was used by the ancients in gout, etc., but falling into disfavor was revived by Störck as a diuretic, expectorant in dropsy, asthma. Again growing into odium, became reëstablished by Want, who thought it a component of *Eau médicinale d'Husson*, a celebrated gout cure.

Poisoning: Have persistent purging, tenesmus, nausea, vomiting, thirst, pain in throat, esophagus, and stomach, suppressed urine, pinched face, dilated pupils, salivation, cold extremities, weak pulse, prostration, headache, delirium, spasms, stupor, death by gastro-enteritis or cardiac paralysis, conscious until the last. Evacuate stomach, if not already done, give tannin, morphine, demulcent drinks, stimulants, heat to extremities, hot abdominal fomentations, castor oil.

Incompatibles: Alcohol, opium (antagonizes cardiac depression), tannin, vegetable infusions.

LILIACEÆ

Synergists: Diuretics, purgatives, emetics, alkalies.

Allied Plant:

1. *Colchicum variega'tum, Oriental Hermodactyls.*—S. Europe, Asia Minor. Corm like official, but surface smooth, whitish to black, bitter, insipid.

ALOE. ALOE, *U.S.P.*

Aloe { **Perryi,** *Baker,* / **vera,** (*Linné*), / **ferox,** *Miller.* } The inspissated juice of the leaves, yielding not more than 4 p. c. ash, 10 p. c. moisture, and 50 p. c. water-soluble extractive.

Habitat. 1. E. Africa, Island of Socotra; cultivated. 2. W. Indies (N. E. Africa, India); cultivated in Curaçao, Aruba, Bonaire, Italy, Sicily, Malta, naturalized in Barbados Island, etc. 3. Cape of Good Hope (S. Africa).

Syn. 1. Aloe Socotrina, Socotrine (*sucus citrinus*)–, Bombay-, Mocha-, Turkey-, Zanzibar-Aloe; Fr. Aloès; Ger. Aloë, Aloe, Socotra Aloe, Socotrinische Aloe. 2. Aloe Barbadensis, Barbados-, Curaçao-, East Indian-, India-, Bitter-, Hepatic-, Horse-Aloe; Fr. Aloès hépatique des Barbades, ou de la Jamaique; Ger. Barbados Aloe. 3. Aloe Capensis, Aloe lucida, Shining (Glassy) Aloe; Fr. Aloes du Cap; Ger. Kapaloe.

Al'o-e. L. fr. Ar. *Alloeh*, Gr. ἀλόη, native names for the aloe.

Per'ry-i. L. after Wykeham Perry, who studied the plant natively.

Ve'ra. L. *verus*, true—*i. e.*, the original and true primitive kind.

Fer'ox. L. fr. *ferox* or *ferus*, fierce, coarse, wild—*i. e.*, large plant with leaves prickly on surface as well as margins.

Plants.—Perennials; stems 1.5 M. (5°) high, woody, rough from leaf-remnants; leaves glaucous-green, often with darker spots, thick, succulent, bayonet-shaped, margin with reddish spines or serratures; flowers racemose or spicate, tubular, yellowish, orange-red; stamens 6, unequal, 3 longer than corolla. Inspissated juice (aloe—*A. Perryi*): *Socotrine*, yellowish-, blackish-brown, opaque, smooth glistening masses, fracture somewhat conchoidal; odor characteristic; (*A. vera*): *Curaçao*, orange, blackish-brown, opaque masses; fracture uneven, waxy, somewhat resinous; odor characteristic, disagreeable; (*A. ferox*): *Cape*, reddish-brown masses, usually with yellowish powder, or in thin, transparent fragments, reddish-brown; fracture smooth and glassy; odor characteristic, sour, disagreeable. With nitric acid, Socotrine aloe—yellowish, reddish-brown solution; Curaçao—deep red; Cape—reddish-brown, to purplish-brown, finally green; taste of each variety very bitter, nauseous. Powder, yellowish-brown, dark reddish-brown; mounted in a bland expressed oil, appears yellowish to reddish-brown angular or irregular fragments, color depending somewhat on thickness of fragments. *Tests:* 1. Shake 1 Gm. + cold water 25 cc. occasionally during 2 hours, place on filter, dry over sulphuric acid, wash with cold water q. s. 100 cc.; residue not over 50 p. c.; color of filtrate light yellowish-brown (socotrine), reddish-brown (curaçao), yellowish (cape), darkens upon standing. 2. 5 cc. above filtrate, + water 45 cc. + 20 cc. sodium borate solution (1 in 20)—green fluorescence, upon standing brownish liquid. 3. 10 cc. above filtrate, +

water 90 cc., shake + benzene 10 cc., separate benzene layer + ammonia T. S. 5 cc.—permanent deep rose color in lower layer. 4. 1 Gm., + 50 cc. alcohol, heat gently, cool,—nearly clear solution (abs. of gum, inorganic impurities). *Solvents:* alcohol; boiling water; cold water (4); insoluble in ether, chloroform. Dose, gr. ½–10 (.03–.6 Gm.).

FIG. 44.—*Aloe Perryi.*

FIG. 45.—*Aloe vera* (*vulgaris*).

ADULTERATIONS.—ALOE: Chiefly dried juice of inferior allied species, small amount of leaves, wood, sticks, stones, leather, monkey and goat skins, implements, knives, nails, iron, resin, pitch, ochre, burned bones, gum, extract of glycyrrhiza, etc.—5–27 p. c., increasing ash to 26.5 p. c. ALOIN: Resinous and other matter, recognized by imperfect solubility in water.

Commercial.—Plants resemble to some extent *Aga've america'na*, American Aloe or century plant, and were known to Dioscorides and Celsus. The large, thick leaves have a central insipid, thick, mucilaginous juice as well as a peripheral bitter, watery, colorless juice (aloetic) in distinct, elongated, thin-walled ducts, which varies in activity with age of leaf and season of year. This superficial juice—possibly a plant protection—is collected when not too scanty or watery, March–April, just after the rainy season, by cutting off the leaves near their base, during sunshine, and standing them up for half an hour in skins depressed in the ground, or in a series of 5 V-shaped wooden troughs (1.2 M.; 4° long—.3–.5 M.; 12–18′ deep), each with an opening in the lower inclined end to run off juice as it exudes by gravity alone (any pressure serving to expel also the undesirable central juice,

possessing emmenagogue properties and suitable for poultices) into iron or copper vessels for evaporation, which continues 5 hours, occasionally ladling out the impurities. The colorless juice on exposure soon becomes yellowish-brown, but may be kept in barrels for months, as it does not spoil, and according to demand reduced slowly by sun (socotrine) or rapidly by fire (curaçao, cape), thus imparting a heavier odor without injuring medicinal properties. In Curaçao immediate evaporation, below the boiling-point, yields a variety called "Capey," from its luster and yellowish powder, but if evaporation is deferred a year the surface is dull, odor suggestive of fermentation; powder brownish, and less soluble in water (4–13 p. c.). When of proper consistence the evaporated product—commercial aloe—is poured into tin-lined boxes, kegs, casks, tubs, monkey or goat skins and sent via Zanzibar to Bombay (socotrine), or into gourds (2–15–50 pounds; 1–7–23 Kg.), boxes (60–100 pounds; 27–46 Kg.), small calabashes and shipped from Curaçao, Bonaire, Jamaica, Barbados (Curaçao), or into boxes, cases, skins, and shipped from Algoa Bay, Cape Town, Mossel Bay (cape). There are three varieties: 1, *Socotrine* (*A. Perryi*), most expensive, highly esteemed and flavored—the best; 2, *Curaçao* (*Barbados—A. vera* (*vulgaris*)), mostly used, and commands a higher price upon keeping; 3. *Cape* (*A. ferox*), production equals all other varieties combined; not used much in this country, but largely in Germany, S. Europe.

Constituents.—Aloin (chiefly—barb-aloin), Resin 30–50 p. c., Emodin (Cape and Barbados) .15–2 p. c., volatile oil (to which disagreeable odor is due) .0015 p. c., moisture 5–10 p. c., ash 1–4 p. c.

Aloinum. Aloin, *U.S.P.*—A pentoside or mixture of pentosides from aloe, varying in chemical composition, physical and chemical properties according to source. Obtained chiefly by dissolving Curaçao aloe (1) in boiling acidulated, HCl or H_2SO_4, water (10), letting stand 24 hours for resin to deposit, decanting, evaporating to 2 parts, setting aside 2 weeks to crystallize—yield 20–25 p. c. It is a microcrystalline powder, minute crystals, lemon-yellow, darker on exposure, odorless, slight odor of aloe, intensely bitter taste; varies in solubility with its composition—soluble in water, alcohol, acetone, ammonia water, solutions of alkali hydroxides, slightly in ether. *Tests:* 1. Aqueous solution—yellow, brown on standing, neutral, faintly acid. 2. Dissolves in alkaline hydroxide solutions—red, yellow becoming red, green fluorescence. 3. Decomposes when added to alkaline solutions, more slowly in acid solutions; alcoholic solution + a drop of ferric chloride T. S.—brownish-green; incinerate—ash .5 p. c.; insoluble residue in water dried —1.5 p. c. 4. Shake 1 Gm. + benzene 10 cc.—filtrate imparts faint pink color to equal volume of 5 p. c. ammonia water (lim. of emodin). Curaçao-aloin, $C_{17}H_{20}O_7$, identical with barb-aloin, ugand-aloin, cap-aloin, when boiled with nitric acid—chrysammic acid, crimson color; soc-aloin, $C_{15}H_{16}O_7$, with nitric acid—no color change; nat-aloin dissolved in sulphuric acid in proximity to glass rod

dipped into nitric acid—solution green, blue, violet, orange-red—but no effect on the two preceding. Twice as active as aloe and usually produces no griping. Should be kept dark, in well-closed containers. Dose, gr. ½–2 (.03–.13 Gm.).

Resin.—Obtained by allowing a dilute aloetic infusion to cool, when it precipitates, filtering, drying. Like aloin, varies according to source, the several kinds being esters of various acids (cinnamic, paracumaric, etc.) with aloresino-tannol; soluble in hot water (thus differing from other resins), alcohol, ether, alkaline solutions, brownish-black by ferric salts; equally active as the drug, due possibly to accidental presence of aloin.

Emodin (*Aloe-emodin*).—Believed to be in Cape and Barbados, but not in Natal or Socotrine, and is obtained by dissolving it in ether from aloin, of which, as well as of aloe, it is the purgative principle. In aloin, just as in anthraglucosennin, rhein, frangulin, and purshianin, the alkaline secretions of the upper intestine must produce decomposition, whereby the emodin thus set free may produce peristalsis, hence the cathartic action of the drug.

PREPARATIONS.—I. ALOE: 1. *Pilulæ Aloes.* Pills of Aloe. (Syn., Pil. Aloes; Br. Pilula Aloes, Aloes Pill; Fr. Pilules d'Aloès et de Savon; Ger. Aloepillen.)

Manufacture: Mix aloe 13 Gm., soap 13, water q. s. 100 pills. Dose, 1–4 pills.

2. *Extractum Colocynthidis Compositum*, 50 p. c. 3. *Tinctura Benzoini Composita*, 2 p. c. 4. *Pilulæ Aloes et Asafœtidæ, N.F.*, āā, 1½ gr. (.09 Gm.). 5. *Pilulæ Aloes et Ferri, N.F.*, āā, 1 gr. (.06 Gm.). 6. *Pilulæ Aloes et Mastiches, N.F.*, 2 gr. (.13 Gm.). 7. *Pilulæ Aloes et Myrrhæ, N.F.*, 2 gr. (.13 Gm.). 8. *Pilulæ Aloes et Podophylli Compositæ, N.F.*, 1 gr. (.06 Gm.). 9. *Pilulæ Aloes Hydrargyri et Podophylli, N.F.*, 2 gr. (.13 Gm.). 10. *Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, N.F.*, 1 gr. (.06 Gm.). 11. *Pilulæ Rhei Compositæ, N.F.*, 1½ gr. (.09 Gm.). 12. *Pilulæ Antiperiodicæ, N.F.*, 2 gr. (.13 Gm.). Dose, each, 1–2 pills. 13. *Pulvis Aloes et Canellæ, Hiera Picra, N.F.*, 80 p. c. + canella 20. Dose, gr. 15–30 (1–2 Gm.). 14. *Tinctura Aloes, N.F.*, 10 p. c. Dose, ʒss 1 (2–4 cc.). 15. *Tinctura Aloes et Myrrhæ, N.F.*, āā 10 p. c. Dose, ʒss–1 (2–4 cc.). 16. *Tinctura Antiperiodica, N.F.*, 3.5, p. c. II. ALOIN: 1. *Pilulæ Aloini Compositæ, N.F.*, ½ gr. (.032 Gm.). 2. *Pilulæ Aloini, Strychninæ et Belladonnæ, N.F.*, ⅕ gr. (.013 Gm.). 3. *Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, N.F.*, ⅕ gr. (.013 Gm.). 4. *Pilulæ Laxativæ Compositæ, N.F.*, ⅕ gr. (.013 Gm.). Dose, each, 1–2 pills.

Unoff. Preps.: Compound Decoction (Br.—1 p. c. of extract). *Extract*, gr. ½–5 (.03–.3 Gm.). *Wine.*

PROPERTIES.—Cathartic, drastic, emmenagogue, vermifuge, stomachic. The action is especially on the colon and lower half of the large intestine, and thus causes irritation to uterus and inflamed hemorrhoids; stimulates the functions of the liver, intestinal secretions generally,

increases the flow of bile, and acts in about 15 hours. Abnormal doses do not produce proportionately excessive results, but invariably cause tormina, tenesmus with heat, and rectal irritation – the latter (stomach and rectum) being remedied largely by combining with soap or an alkaline carbonate.

Uses.—Costiveness (dependent upon weakness of muscular layer of the large intestine), atonic dyspepsia, jaundice, non-active hemorrhoids, amenorrhea, ascarides; for the two last may give by enema.

Poisoning: Have irritation of intestinal canal, causing pain, vomiting, and purging, cold sweats, prostration, sometimes convulsions, collapse. Empty stomach, give demulcents, opium, stimulants, artificial heat to body and extremities, hot fomentations to abdomen.

Allied Products:

1. *Hepatic Aloe.*—This name was applied formerly to a variety of Socotrine aloe from E. Indies, but now the term is given in this country to Barbados, in fact to any opaque liver-colored aloe.

2. *Natal Aloe.*—This has a greenish-slate hue, crystalline, fracture less shining than, but odor of Cape aloe; it is of little value, and is shipped from Port Natal.

3. *Moka Aloe.*—This has brownish-black color, irregular fracture, disagreeable odor, and is from the interior of Arabia.

4. *Caballine* or *Horse Aloe.*—This is inferior, impure, having a dark color, fetid odor, being from irregular sources.

5. *Jafferabad Aloe.*—This has black-pitch color and luster, glassy, porous fracture, and is less agreeable than Socotrine aloe.

Allied Plants:

Fig. 46.—*Allium sativum.*

1. *Al'lium sati'vum, Allium, Garlic, N. F.* —The fresh bulb: C. Asia, S. Europe. Bulbous plant .6 M. (2°) high; leaves long, flat, grass-like; flowers small, white umbels. Bulb, subglobular, 4–6 Cm. ($1\frac{3}{5}$–$2\frac{2}{5}$′) broad, compound, with 8–15 bulbels surrounded by whitish membranaceous scales and attached to a flattened circular base having numerous yellowish-white roots; bulbels ovoid, 3–4-sided, apex acute; each bulbel covered by whitish membranaceous scale-like leaves and pinkish layer of epidermis cohering but easily separable from solid portion; odor when bruised powerfully alliaceous; taste intensely pungent, persistent; contains volatile oil .25 p. c., mucilage 35 p. c., albumin, sugar, starch, water 60 p. c. Stimulant, carminative, condiment, diuretic, expectorant, rubefacient; bronchitis, indigestion, infantile catarrh; poultice in catarrhal pneumonia, abscesses, earache, convulsions of children, insect and serpent wounds. Dose, ʒss–1 (2–4 Gm.); 1. *Syrupus Allii,*

20 p. c.—garlic 20 Gm., sucrose 80, diluted acetic acid q. s. 100 cc. (50 cc. +), dose, ʒj-4 (4–15 cc.); volatile oil, ♏j-5 (.06–.3 cc.). *A. Ce'pa Onion* and *A. Por'rum, Leek* are used like garlic.

2. *Al'etris farino'sa, Aletris, Star Grass, Unicorn Root, N.F.*—The dried rhizome and roots with not more than 5 p. c. of foreign organic matter, yielding not more than 10 p. c. of acid-insoluble ash; United States—southern pine-barrens. Perennial, .6–1 M. (2–3°) high; leaves radical, star-shaped, 7.5–10 Cm. (3–4′) long, 2.5 Cm. (1′) broad; flowers white, as though dusted with meal (indumentum—*farinosa*). Rhizome, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}$′) long, 5–10 Mm. ($\frac{1}{5}$–$\frac{2}{5}$′) thick, grayish-brown, circular stem-scars above, numerous tough, wiry, flexuous roots on sides and beneath; fracture short; internally light brown, cortex 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, twisted fibro-vascular bundles; odor slight, acetous; taste sweetish, bitter. Powder, yellowish-brown—tracheæ, lignified cells, parenchyma with starch grains, numerous calcium oxalate raphides, glandular hairs; contains starch, bitter principle. Uterine tonic, diuretic, emetic, purgative; chronic rheumatism, dropsy, colic. Dose, gr. 5–15 (.3–1 Gm.); 1. *Fluidextractum Aletridis* (diluted alcohol): Preps.: 1. *Elixir Aletridis Compositum*, fldexts.—aletris, mitchella, helonias, caulophyllum, āā, 6.55 p. c. + fldext. viburnum opulus 3.27 p. c.; 2. *Elixir Viburni Opuli Compositum*, 7.5 p. c. Decoction, Tincture.

3. *Erythro'nium america'num, Yellow Adder's-tongue.*—The root and herb, U. S. P. 1820-1850; United States. Perennial herb, scape 15–22.5 Cm. (6–9′) high, slender, leaves 2, pale green, equal length 12.5 Cm. (5′), one twice as wide as the other, brown-spotted, flowers yellow, 2.5–5 Cm. (1–2′) long, root (bulb or corm) solid, brown; inside white. All parts of the plant active; used like colchicum. Dose, gr. 20–30 (1.3–2 Gm.) in infusion. Large doses emetic.

SCILLA. SQUILL, *U.S.P.*

Urg̀inea maritima, (*Linné*) *Baker.* { The cut and dried fleshy inner bulb scale of the white variety.

Habitat. Mediterranean Basin, near the sea; Spain, France, Italy, Greece, Portugal, Morocco, Algeria; in dry, sandy, also hilly localities.

Syn. Scill., Sea Onion, White or Red Squills; Fr. Scille, Squille; Ger. Bulbus Scillæ, Meerzwiebel.

Ur-gin'e-a. L. *urgere*, to press, urge—*i. e.*, its flattened, compressed seed, or fr. Algerian Arab tribe *Ben urgin.*

Ma-rit'i-ma. L. *maritimus*, of the sea, maritime—*i. e.*, its habitat near the sea.

Scil'la. L. fr. Gr. σκίζειν, to split—*i. e.*, splits into scales; σκίλλα, an onion.

Plant.—Perennial herb; roots fibrous from base of large bulb; leaves appear long after flowers, several, .5–.6 M. ($1\frac{1}{2}$–2°) long, shining, deep green; flowers white, on succulent stem, .3–1 M. (1–3°) high, in close spike, no calyx, peduncles purplish; fruit, dry capsule 12 Mm. ($\frac{1}{2}$′) long, oblong, 3-lobed, yellow, seed 6 in each cell, 6 Mm. ($\frac{1}{4}$′) long,

flattened, purplish-brown. Bulb scale, in irregular, curved, flattened pieces, .5–5 Cm. ($\frac{1}{5}$–2′) long, yellowish-white, somewhat translucent; brittle when dry, tough and flexible when damp; odor slight; taste bitter, mucilaginous, acrid. Powder, yellowish-brown, very hygroscopic caking in moist atmosphere—numerous calcium oxalate raphides isolated and in bundles imbedded in mucilage, fragments of parenchyma with occasional spiral and reticulate tracheæ, very few starch grains. Should be kept dry, in tightly-closed containers. *Solvents:* 75 p. c. alcohol; diluted acetic acid; vinegar; water. Dose, gr. 1–5 (.06–.3 Gm.), ter die until nauseated; gr. 5–10 (.3–.6 Gm.) usually will cause vomiting.

Fig. 47.—*Urginea maritima.*

Fig. 48.—Scilla bulb, prepared for slicing.

Commercial.—Plant recognized a valuable medicine from early times, but first cultivated in Europe, 1630; flowers in autumn, while leaves appear in the following spring. Bulb, size of fist to a child's head, often weighing 4 pounds (1.8 Kg.), grows half-immersed in the soil, being collected in August, deprived of dry outer scales and central portion (this latter of youngest growth and deficient activity), cut transversely into thin slices, and, owing to mucilaginous and hygroscopic qualities, dried carefully (negligence here yielding always inferior product), then packed in casks and shipped from Malta. When fresh abounds in viscid, acrid juice, which on handling produces excoriation with intolerable itching—a property lost upon drying without medicinal impairment. There are two varieties: 1, *White* (white scales); 2, *Red* (reddish-brown scales), both possessing identical properties, the former, however, being preferred, as it yields less colored solutions; loses on drying 80 p. c., and on exposure reabsorbs 11 p. c. of moisture, becoming moldy, hence the necessity of dry preservation.

Constituents.—Scillitin (scillipicrin, scillitoxin, scillin), Sinistrin, sugar 22 p. c., volatile oil, calcium oxalate 3–8 p. c., ash 3 p. c.

Scillitin.—Bitter principle, upon which activity depends, but it has never been obtained pure. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.). Instead of this, Merck gives 3 active principles:

(1) **Scillipicrin.**—Bitter principle, yellowish-white, amorphous, soluble in water, hygroscopic; acts upon the kidneys. Dose, gr. $\frac{1}{3}$–1 (.02–.06 Gm.).

(2) **Sillitoxin** (**Scillain**).—Glucoside, brown, bitter, burning taste, amorphous, insoluble in water, ether, soluble in alcohol; acts upon kidneys and heart. Dose, gr. $\frac{1}{60}$–$\frac{1}{30}$ (.001–.002 Gm.).

(3) **Scillin.**—Crystalline, pale yellow, soluble in alcohol, hot ether; benumbs, induces vomiting. S. Wanizewski has suggested the following names for the active principles: (1) Scillipicrine, soluble in water, alcohol; (2) Scillimarine, soluble in chloroform, alcohol; (3) Scillinine, soluble in alcohol, insoluble in water, chloroform.

Sinistrin, $C_6H_{10}O_5$.—White mucilage, resembles dextrin, levorotatory, easily converted into levulose by boiling with diluted sulphuric acid.

PREPARATIONS.—1. *Acetum Scillæ.* Vinegar of Squill. (Syn., Acet. Scill.; Fr. Vinaigre (Acétolé) de Scille—scillitique; Ger. Meerzwiebelessig.)

Manufacture: 10 p. c. Macerate for 7 days, 10 Gm. with diluted acetic acid 90 cc., strain, add through strainer diluted acetic acid nearly q. s. 100 cc., heat to boiling, filter hot, cool, add diluted acetic acid q. s. 100 cc. Dose, ♏v–30 (.3–2 cc.).

Preps.: 1. *Syrupus Scillæ.* Syrup of Squill. (Syn., Syr. Scill., Syrupus Aceti Scillæ; Fr. Sirop de Scille; Ger. Meerzwiebelsirup.)

Manufacture: 4.5 p. c. Dissolve, with gentle heat, sucrose 80 Gm. in vinegar of squill 45 cc., strain, cool, add through strainer water q. s. 100 cc., mix thoroughly. Dose, ʒss–1 (2–4 cc.).

2. *Oxymel Scillæ, N. F.*—Vinegar of squill 50 Gm., honey 100, evaporate to 100 Gm. Dose, ʒss–2 (2–8 cc.).

2. *Fluidextractum Scillæ.* Fluidextract of Squill. (Syn., Fldext. Scill., Fluid Extract of Squill, Extractum Scillæ Fluidum; Fr. Extrait fluide de Scille; Ger. Meerzwiebelfluidextrakt.)

Manufacture: Macerate for 2 hours 100 Gm. with a portion of alcohol 200 cc. + water 100 cc., pack, macerate for 48 hours, percolate with menstruum until 100 cc. obtained; close lower orifice, macerate for 12 hours, collect a second 100 cc., again interrupt percolation for 12 hours, and continue percolation until total percolate 500 cc.; reclaim alcohol, evaporate to 80 cc., cool, add slowly, with continuous agitation, alcohol 200 cc., set aside for 12 hours, decant supernatant liquid from the syrupy layer, filter the former, wash the latter twice with 80 p. c. alcohol 30 cc., adding washings through filter to previously collected alcoholic liquid, reclaim combined alcoholic liquid to 80 cc., add diluted alcohol q. s. 100 cc. Dose, ♏j–5 (.06–.3 cc.).

Preps.: 1. *Syrupus Scillæ Compositus.* Compound Syrup of

Squill. (Syn., Syr. Scill. Co., Hive Syrup, Croup Syrup; Fr. Sirop de Scille composé; Ger. Zusammengesetzter Meerzwiebelsirup.)

Manufacture: 8 p. c. Dissolve antimony and potassium tartrate .2 Gm. in distilled water 36 cc., add fluidextract of squill and fluidextract of senega, āā, 8 cc., allow to stand 12 hours, shaking, filter; dissolve sucrose 72 Gm. in clear filtrate by agitation, add water q. s. 100 cc.; mix and strain. Dose, ♏v–60 (.3–4 cc.). Cox's Hive Syrup differs from this preparation only in the use of honey instead of sucrose as the preservative. 2. *Mistura Pectoralis, N. F.*, 3.5 p. c.

3. *Tinctura Scillæ.* Tincture of Squill. (Syn., Tr. Scill.; Fr. Teinture de Scille; Ger. Meerzwiebeltinktur.)

Manufacture: 10 p. c. Menstruum 75 p. c. alcohol—moisten squill 10 Gm. with sufficient menstruum, macerate in closed vessel in moderately warm place for 24 hours, stirring occasionally, transfer to percolator, shake down evenly without packing, add menstruum, macerate for 24 hours, proceed slowly, gradually adding menstruum q. s. 95 cc.; adjust biologically. Dose, ♏v–30 (.3–2 cc.).

4. *Pilulæ Digitalis, Scillæ et Hydrargyri, N.F.*, 1 gr.

Unoff. Preps.: Acetic Extract, gr. $\frac{1}{6}$–2 (.01–.13 Gm.). Compound Pill of Squill, (Br.).

Properties.—Resembles digitalis; expectorant, diuretic, emetic, cardiac stimulant, cathartic, irritant. Large doses irritant poison, causing gastro-enteritis, strangury, bloody urine, convulsions, death by heart paralysis.

Uses.—Expectorant in croup, irritant coughs, whooping cough, bronchitis, asthma, associated with ipecac, ammonia, asafetida, benzoin, etc. Owing to its irritating properties should not be given in acute stage. Diuretic in dropsies from cardiac disease, when it should be combined with digitalis or saline diuretics. Give to children with croup until nausea and vomiting occur. The Greeks, Romans, and Arabians used it in dropsies, ulcerated gums and throat, weak digestion. Fresh juice applied to abrasions is diuretic; to healthy skin rubefacient, which may be due to calcium oxalate needle-shaped crystals or to contained acrid resinoid—here also get ultimately the diuretic effect.

Poisoning: Similar to digitalis,—may even induce cardiac arrhythmia and heart block. Evacuate stomach, give tannin, demulcents, opiates, stimulants, etc.

Allied Plants:

1. *Convalla'ria maja'lis, Lily-of-the-Valley, Convallariæ Radix, Convallaria Root, Lily-of-the-Valley Root, N.F.*—The dried rhizome and roots with not more than 5 p. c. of leaves or other foreign organic matter, yielding not more than 6 p. c. of acid-insoluble ash; United States; cultivated in gardens. Stemless perennial; leaves 2–3, radical, smooth, elliptical; flowers campanulate, white, 1-sided raceme. Rhizome, variable length, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick, brownish, few circular

stem-scars, 3–5 thin, tortuous, branching roots on lower portions of nodes; fracture short, fibrous, internally whitish; odor faint; taste sweetish, bitter, acrid. Powder, brown—cakes on standing, few starch grains and calcium oxalate raphides, endodermal cells with porous walls, tracheæ; solvents: diluted alcohol, boiling water partially; contains convallamarin, convallarin, resin. Heart tonic, diuretic, emetic, purgative, sternutatory, poisonous, similar to digitalis, but non-cumulative; heart greatly slowed; arrhythmia, "cardiac hurry", dropsy. Dose, gr. 2–10 (.13–.6 Gm.); 1. *Fluidextractum Convallariæ Radicis* (75 p. c. alcohol), dose, ♏ij–10 (.13–.6 cc.). Extract or convallamarin, gr. ½–2 (.03–.13 Gm.); Infusion, 25 p. c., ℥ss–1 (15–30 cc.). *Poisoning:* Symptoms and treatment similar to digitalis.

2. *Tril'lium erec'tum, Trillium, Beth (Birth) Root, N. F.*—The dried rhizome with not more than 2 p. c. of foreign organic matter; N. America, Stem 20–40 Cm. (8–16′) high, terminated by a whorl of 3 rhombic leaves and a purplish, solitary, unpleasantly scented flower; fruit ovoid, horny. Rhizome, .6–5 Cm. (⅕–2′) long, 1–3 Cm. (⅖–1⅕′) broad, compressed, annulated by leaf-scars and fissured by stem-scars; rootlet scars in concentric rows on under side, yellowish-brown, internally pale yellow; fracture uneven, hard or spongy; odor distinct; taste bitter, acrid, on chewing—warmth in throat and secretion of saliva. Powder, yellowish-white—calcium oxalate raphides, starch grains, epidermal tissue with porous walls, tracheæ with markings; solvent: diluted alcohol; contains saponin-like body (activity) 5 p. c., trilline, fixed oil, volatile oil, resin, tannin, starch, ash 5 p. c. Alterative, expectorant, astringent, oxytocic; uterine stimulant, indolent ulcers, injuries. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Trillii* (75 p. c. alcohol): Prep.: 1. *Elixir Viburni Opuli Compositum,* 15 p. c.

Fig. 49.—*Convallaria majalis.*

3. *Polygona'tum (Convallaria) multiflo'rum, European Solomon's Seal,* and *P. commuta'tum (gigante'um), American Solomon's Seal.*—Rhizome similar and contains convallarin, asparagin, mucilage, starch.

4. *Vag'nera (Smilaci'na) racemo'sa, False Solomon's Seal.*—N. America.

9. SMILACEÆ. Smilax Family.

Smi-la'se-e. L. *Smil-ax* + aceæ, fr. Gr. σμίλη, a scraper—*i. e.*, alluding to the rough, prickly stems. Mostly vines, woody or herbaceous,

SMILACEÆ

stems often prickly. Distinguished by 3–5-nerved (net-veined) leaves, punctate; flowers 6's, umbels, anthers 2-celled, extrorse, ovary 3-celled; fruit globose-berry containing 1–6 brownish seed; warm and temperate climates; alterative, diuretic, diaphoretic.

Genus: **1. Smilax.**

SARSAPARILLA. SARSAPARILLA, *U.S.P.*

Smilax { **medica,** *Chamisso et Schlechtendal,* **officinalis,** *Kunth,* **ornata,** *Hooker filius.* } The dried root (rhizome and crown portion being excluded before grinding or powdering) with not more than 2 p. c. foreign organic matter, yielding not more than 2 p. c. (Mexican 4 p. c.) acid-insoluble ash.

Habitat. Tropical America, Mexico to Brazil; Andes and Chinqui Mountains, 1,200–2,400 M. (4,000–8,000°) elevation; swampy forests.

Syn. Sarsap., 1. Mexican, Vera Cruz, Tampico Sarsaparilla; 2. Honduras, Bearded, Red Sarsaparilla; 3. C. America, Jamaica, Costa Rica, Lima Sarsaparilla; Sarsæ Radix; Fr. Salsepareille du Mexique; Ger. Radix Sarsaparillæ, Sarsaparille.

Smi'lax. L. Bindweed, Gr. σμῖλαξ, the yew, fr. σμίλη (Eng. smile), a scraper—*i. e.*, stems rough with prickles.

Med'i-ca. L. *medicus*, medical, curative—*i. e.*, its healing properties.

Of-fi-ci-na'lis. L. *officina*, a work shop, = *opus*, work, + *facere*, to do, to make —*i. e.*, used in or belonging to the shop or store.

Or-na'ta. L. *ornatus*, fr. *ornare*, to adorn—adorned, decorated, ornamented —*i. e.*, beautiful fruit and foliage.

Sar-sa-pa-ril'la. L. fr. Sp. *zarzaparilla—zarza*, a bramble, + *parra*, a vine, or from *Parillo*, a physician said to have discovered and employed it.

Plants.—Large perennial, thorny climbers; rhizomes short, thick, knotted, nodes thick, from which spring purplish-white roots 2–2.5 M. (6–8°) long, and a few rootlets; stems many, stiff, woody, angular, ridged, subterete or quadrangular, prickles at nodes; leaves 10–30 Cm. (4–12′) long, 7.5 15 Cm. (3 6′) wide, petioles 5 Cm. (2′) long, quadrangular, cordate, rounded lobes at base, entire, glabrous, leathery, dark glossy green; flowers diœcious, 10 20 together in umbels; fruit small berry, 8 Mm. ($\frac{1}{3}$′) thick, red, 2–3-seeded. Root (*S. medica*): *Mexican*, in loose bundles, or pressed bales, single bundles, 30–60 Cm. (12 24′) long, composed of 20–35 folded roots attached to a crown with one or more stout stems; roots 3.5–6 Mm. ($\frac{1}{7}$–$\frac{1}{4}$′) thick, usually shrunken forming sharp longitudinal ridges and broad furrows, often containing some blackish earth, grayish-brown, dark brown, finely hairy; nearly devoid of branches or fibrous rootlets; fracture brittle (cortex), tough and fibrous (central cylinder); cortex mealy, whitish, brownish, horny; woody zone yellow, porous; pith whitish, distinct; nearly odorless; taste mucilaginous, sweetish, acrid; (*S. officinalis*): *Honduras*, in compact, cylindrical bundles, 30–55 Cm. (12–22′) long, 8–15 Cm. (3–6′) thick, composed of long, folded roots bound together by a number of circular turns; roots 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}$′)

thick; dark-, reddish-brown, longitudinally wrinkled or finely furrowed, usually without earth, with occasional fibrous rootlets; fracture short, sometimes tough and fibrous (central cylinder); internally reddish-brown, dark brown, occasionally light gray cortex, a light yellow porous woody zone and a whitish pith; (*S. ornata*): *Central American, Jamaica,* in more or less compact, somewhat flattened bundles, 30–45 Cm. (12–18′) long, 10–15 Cm. (4–6′) broad, composed of folded roots loosely

FIG. 50.—Smilax: branch with flowers and fruit.

bound together by a few circular turns; roots 2–5 Mm. ($\frac{1}{12}$—$\frac{1}{5}$′) thick, grayish-, reddish-brown, longitudinally wrinkled, occasionally nearly smooth, rarely furrowed, without earth, bearing numerous coarse fibrous rootlets; fracture short or tough and fibrous in central cylinder, internally white or dark brown cortex, and porous wood zone, a yellow or white pith. POWDER, grayish-brown—numerous starch grains, .003–.023 Mm. ($\frac{1}{8300}$—$\frac{1}{1075}$′) broad, spherical, biconvex calcium oxalate raphides, singly or in groups up to .15 Mm. ($\frac{1}{175}$′) long; cells of hypo-

dermis and endodermis with lemon-yellow, reddish-yellow porous walls (Mexican—uneven or irregular thickening), cells being .08–.5 Mm. ($\frac{1}{1\,2\,5}$–$\frac{1}{5\,0}$′) long; fragments of tracheæ with thickenings, fibers with thin lignified or porous walls. *Solvents:* diluted alcohol; boiling water, injured by continued boiling. Dose, ʒss–2 (2–8 Gm.).

Commercial.—Sarsaparilla was carried to Europe from Peru, St. Domingo, Brazil, by the Spaniards in 1550, and has been in general use ever since. Plants occur in very thick undergrowth that renders careful collection quite troublesome, which is effected by grubbing,

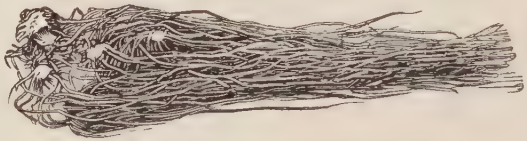


Fig. 51.—Mexican sarsaparilla.

pulling, etc., so as to avoid extermination; those fully grown often yield at first cutting 30–60 pounds (13.6–27 Kg.), and every 2 years thereafter smaller quantities of more slender, less starchy roots. Collectors accept as best that having many roots from stem, persistent acrid taste, closely set prickles and thin leaves, and according to physical properties recognize two kinds (*a*) *Non-mealy:* Mexican, Jamaica, thin, not cracked, red, brown, little or no starch, usually pasty, rarely in granules, somewhat horny with longitudinal and irregular folds; thought best as bark and pith are relatively small, roots have more rootlets, greater acridity, and yield most extract,

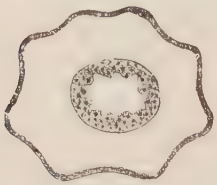


Fig. 52.—Mexican sarsaparilla: cross-section; magnified 3 diam.

Fig. 53.—Central American, Jamaica sarsaparilla.

dissolving clearly in cold water; (*b*) *Mealy:* Honduras, Para, more or less swollen, pale yellow, transversely cracked, considerable starch, usually in fine granules, seldom pasty. There are four varieties: 1, *Mexican*, once thought valueless, but now, owing to acridity, most valuable; grows in Mexican Andes, around Orizaba, Vera Cruz, etc., being considered a variety of *S. officinalis*, with slender branches, and often without prickles; 2, *Central American, Jamaica*, grown chiefly in Costa Rica, some in the Amazon Valley, and called "Jamaica" as it is exported through that province; resembles Honduras, but redder,

less wrinkled and amylaceous, and yields more extract; 3, *Honduras*, most popular, grown in Honduras, Guatemala, Peru, Colombia, C. America; enters market in bales, skins, 100 pounds (45.3 Kg.); 4, *Para* (*Brazilian, Rio Negro, Lisbon—S. papyra'cea*), in compact cylindrical bundles, 30–90 Cm. (12–36′) long, 15–20 Cm. (6–8′) thick, closely and neatly bound, by a stem of a vine, and ends evenly trimmed; rootlets few, dark, amylaceous, acrid, resembling Honduras, and growing in N. Brazil, Guiana (Para, Maranham); considered a variety of *S. officinalis*, with older stems and lower branches remaining square, angles with flattened prickles and much more membraneous leaves; rather rare, and the only one of the four varieties not recognized in U. S. P.

Fig. 54.—Honduras sarsaparilla.

The *Guayaquil* (*S. officinalis*), growing in W. Andes valleys, occasionally enters market, usually loose and carelessly packed in bales, rhizome and stem portions often included; roots dark with much fiber, bark furrowed, thick, somewhat amylaceous, internally pale yellow. Roots are taken also from *S. syphilit'ica* (Colombia), *S. glau'ca* (Mexico) *S. util'is* (Jamaica), etc.

Constituents.—Saponin-like substance (separable into 3 glucosides—Sarsasaponin, Parillin, Smilasaponin) 3 p. c., volatile oil, resin, starch 10–15 p. c., pectin, coloring matter, calcium oxalate and other salts, ash 7–10 p. c.

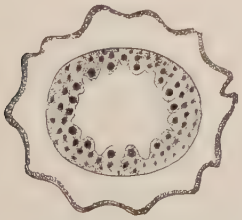


Fig. 55.—Honduras sarsaparilla: cross-section; magnified 3 diam.

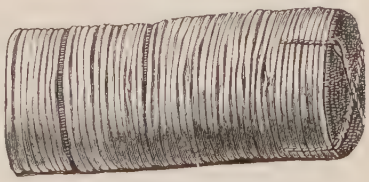


Fig. 56.—Para sarsaparilla.

Sarsasaponin, $C_{22}H_{36}O_{10}$, is the most important component, being 3–4 times more active than the other two; it is crystallizable, soluble in water, alcohol, more so with heat.

Parillin (**Smilacin**), $C_{26}H_{44}O_{10}$, crystallizable, soluble in water, alcohol, frothing with agitation, aqueous solution precipitated by lead acetates, tannin; boiled with diluted acids splits into sugar and parigenin.

Smilasaponin, $C_{20}H_{32}O_{10}$, non-crystallizable, soluble in water, alcohol.

SMILACEÆ

PREPARATIONS.—1. *Fluidextractum Sarsaparillæ.* Fluidextract of Sarsaparilla. (Syn., Fldext. Sarsap., Fluid Extract of Sarsaparilla; Extractum Sarsæ Liquidum; Fr. Extrait fluide de Salsepareille; Ger. Sarsaparillafluidextrakt.)

Manufacture: Moisten, macerate for 6 hours in tightly-covered containers 100 Gm. with enough diluted alcohol, pack, percolate with same menstruum until exhausted, reserve first 85 cc., reclaim alcohol, evaporate to soft extract, which dissolve in the reserve, mix thoroughly, add menstruum q. s. 100 cc. Dose, ʒss–1 (2–4 cc.).

Preps.: 1. *Syrupus Sarsaparillæ Compositus.* Compound Syrup of Sarsaparilla. (Syn., Syr. Sarsap. Co., Syrupus Sudorificus; Fr. Sirop de Salsepareille composé, Sirop sudorifique; Ger. Zusammengesetzter Sarsaparillsirup.)

Manufacture: Fluidextract of sarsaparilla 20 cc., fluidextract of glycyrrhiza 1.5, oil of sassafras .02, oil of anise .02, methyl salicylate .02, alcohol 1.94, add this solution to syrup 76.5 cc. Dose, ʒj–4 (4–15 cc.). Prep.: 1. *Syrupus Bromidorum, N.F.*, 45 p. c.

2. *Fluidextractum Sarsaparillæ Compositum, N.F.*, 75 p. c. + glycyrrhiza 12, sassafras 10, mezereum 3. Dose, ʒss–1 (2–4 cc.).

Unoff. Preps.: Compound Decoction 10 p. c. (+ sassafras 2, guaiacum wood 2, glycyrrhiza 2, mezereum 1), ʒj–4 (30–120 cc.). *Decoction. Extract,* gr. 5–10 (.3–.6 Gm.). *Extract Comp.*; *Syrup.*

PROPERTIES.—Alterative, diuretic, diaphoretic, tonic. Mostly believed to be of little service unless associated with other drugs, such as potassium iodide, guaiac, sassafras, mezereum, etc.

USES.—As a blood purifier in scrofula, cutaneous diseases, abscesses, ulcers, tertiary syphilis with mercuric chloride or potassium iodide or both; gout, rheumatism.

Incompatibles: Alkalies, iodine, and corrosive sublimate is claimed to be converted into calomel by the compound syrup. *Smilax chi'na, S. pseu'do-china, S. tamnoi'des, S. as'pera* and *Ca'rex arena'ria, German Sarsaparilla,* are used like official.

Allied Plants:

1. *Dioscore'a villo'sa, Dioscorea, Wild Yam Root, Colic (Rheumatism) Root, N.F.*—Dioscoreaceæ. The dried rhizome with not more than 2 p. c. of foreign organic matter; United States; moist thickets. Slender twining climber, dioecious; leaves ovate, cordate, acute; flowers greenish, panicles; fruit triangular winged capsule. Rhizome, knotted, woody, elongated, 6–20 Mm. ($\frac{1}{4}$–$\frac{4}{5}$′) thick, often compressed, bent, branched, nodular, stem-scars above, slender tough roots beneath, pale brown, scaly; fracture short, tough, yellowish, scattered wood-bundles; odorless; taste starchy, insipid, acrid. Powder, whitish—parenchyma cells, starch grains, few calcium oxalate raphides, fibro-vascular bundles with tracheæ and tracheids, epidermal tissue; contains resin, saponin body, starch (dioscorein—"Eclectic" resinoid), ash 2–7 p. c. Diaphoretic, expectorant, emetic; rheumatism, bilious colic.

Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Dioscoreæ* (diluted alcohol). 2. *Tinctura Viburni Opuli Composita*, 3.5 p. c. Decoction, Tincture, Dioscorein, gr. 1–4 (.06–.25 Gm.).

2. *Iris versic'olor*, *Blue Flag*, *N.F.*—Iridaceæ. The dried rhizome with not more than 5 p. c. of roots and leaf bases or other foreign organic matter; N. America; swampy places. Perennial herb, .6–1 M.

Fig. 57.—*Iris versicolor:* joint of rhizome and section of branches.

2–3°) high; stem angled on one side, branched; leaves narrow, equitant, sword-shaped; flowers lily-like, beautiful purplish-blue, with yellowish and whitish markings at base of sepals. Rhizome, often branched, 5–20 Cm. (2–8′) long, 3 Cm. ($1\frac{1}{5}$′) thick at nodes, usually cut pieces, grayish-brown, annulate, markings of leaf bases above, root-scars and remnants below; fracture short, yellowish, exhibiting central stele, whitish fibro-vascular bundles, distinct endodermis and cortex; odor slight, not distinctive; taste acrid, nauseous. Powder, brownish—resin cells filled with amorphous substance, starch grains, calcium oxalate prisms, tracheæ with markings, pores, few fibers; contains extract (resin) 25 p. c., volatile oil .025 p. c., isophthalic acid, sugar, phytosterol, myricyl alcohol, heptatosane, ipuranol, cerotic acid, ash 7 p. c. Cholagogue, emetic, diuretic, alterative; costiveness, malarial jaundice, bilious remittent fever, dropsy; very nauseating and prostrating; hepatic stimulant equal to podophyllum and less irritating, more pungent than euonymus. Dose, gr. 5–20 (.3–1.3 Gm.); 1. *Fluidextractum Iridis Versicoloris* (alcohol), dose, ♏v–20 (.3–1.3 cc.): Prep.: 1. *Elixir Corydalis Compositum*, 9 p. c.; 2. *Fluidextractum Stillingiæ Compositum*, 12.5 p. c.: Prep.: 1. *Syrupus Stillingiæ Compositus*, 25 p. c. Extract, gr. 1–4 (.06–.26 Gm.); Irisin, iridin ("Eclectic" oleoresin or resinoid), gr. 1–4 (.06–.26 Gm.).

Fig. 58.—Iris in bloom.

4. *Iris florenti'na* or *I. german'ica*, or *I. pal'lida*, *Orris (Florentine)*, *Orris Root*, *N.F.*—The rhizome with not more than 1 p. c. of foreign

SMILACEÆ

organic matter. N. Italy (near Florence), Germany, France. Perennial plant, leaves radical, sword-shape, shorter than stem, which rises in their midst (.3–.6 M.; 1–2°) high, bearing 2 large white or bluish flowers; fruit capsule, 3-celled, many-seeded. Rhizome, various formed and sized pieces, usually jointed, branched, 5–10 Cm. (2–4′) long, 1.5–3 Cm. ($\frac{3}{5}$–$1\frac{1}{5}$′) wide, knotty enlargements; leaf-scars above, numerous root-scars below, yellowish-white; fracture hard, rough, mealy, narrow cortex, distinct endodermis, large stele, many vascular bundles; odor fragrant, resembling violet; taste aromatic, bitterish. Powder, light yellow—parenchyma cells filled with characteristic starch grains, tracheæ with markings, calcium oxalate prisms; solvent: alcohol; contains volatile oil (orris butter), iridin, starch, resin, tannin, ash 5 p. c. Stimulant, diuretic, emetic, cathartic; fresh root irritant;

FIG. 59.—*Crocus sativus.*

FIG. 60.—Crocus; *a*, stigma, upper part magnified 4 diam.; *b*, style with stigmas; *c*, papillose margin of stigma, magnified 120 diam.

diarrhea, bronchitis, dropsy, tooth powder, masticatory for perfuming breath and teething infants; for this latter the more slender pieces are peeled smoothly and whitened with chalk or magnesium oxide; 1. *Species Pectorales*, 5 p. c. *Adulterations:* Rhizomes of *I. pseudac'orus* and *I. fœtidis'sima*, both being somewhat darker, more astringent and acrid.

5. *Cro'cus sati'vus, Crocus, Saffron, N.F.*—The stigma with not more than 10 p. c. of yellow styles and 2 p. c. of other foreign organic matter, yielding not more than 7.5 p. c. of total ash; W. Asia, Spain, France. Low perennial bulbiferous herb with depressed globular corm (bulb), 2.5 Cm. (1′) thick; leaves grass-like; flowers lilac, bluish-purple. Stigmas 3, united or separate, attached to apex of style, 25 Mm. (1′) long, cornucopia-shaped, dark, rich red (developed by toast-

ing after being collected), margin dentate or fimbriate, styles 10 Mm. ($\frac{2}{5}'$) long, solid, yellowish, odor strong, peculiarly aromatic; taste bitterish, aromatic, colors saliva orange-yellow; with sulphuric acid—blue, gradually changing to violet, deep red-wine; macerated in water—yellow solution, in methyl alcohol—deep orange; contains picrocrocin (saffron-bitter—by hydrolysis yielding volatile oil and fructose), crocin (impure—amorphous), fixed oil, ash 7.5 p. c. *Adulterations*—common: florets, dyed stamens, petals, moisture 12 p. c., mineral matter (sodium bicarbonate, biborate, sulphate, potassium nitrate, Rochelle salt, lactose, etc.), increasing ash 17–32 p. c. There are three varieties: 1. Austrian (best); 2, French (Gatinais); 3, Spanish (inferior from presence of style bases and stigmas); known as *hay saffron*, as distinguished from *cake saffron*, which is no longer in commerce. Diaphoretic, carminative, emmenagogue, anodyne; to promote exanthematous eruptions in measles, etc., dysmenorrhea, conjunctivitis. Should be kept dark, in tightly closed containers. Dose, gr. 5–30 (.3–2 Gm.); 1. *Tinctura Croci*, 10 p. c. (diluted alcohol), dose, ʒj–2 (4–8 cc.); 2. *Tinctura Opii Crocata*, 2.5 p. c.; 3. *Pilulæ Antiperiodicæ*, $\frac{1}{4}$ gr.; 4. *Tinctura Antiperiodica*, $\frac{2}{5}$ p. c. *Infusion* (tea), 2 p. c., ℥ij–4 (60–120 cc.).

10. ZINGIBERACEÆ. Ginger Family.

Zin-ji-be-ra′se-e. L. *Zingiber* + aceæ, fr. Gr. ζιγγίβερις, ginger. Herbs. Distinguished by being aromatic, with creeping rhizomes, leaves stalked, broad, sheathing, parallel veins from midrib. Perianth superior, irregular. Each whorl 3, stamens 6, in 2 whorls, outer whorl staminodial or absent; ovary 3-celled, inferior; fruit 1–3-celled, capsule or berry; seeds many, arillate; tropics; stimulant; aromatic, stomachic (resin + vol. oil), starch, food.

Genera: **1. Zingiber. 2. Elettaria.**

ZINGIBER. GINGER, *U.S.P.*

Zingiber officinale, *Roscoe.* { The dried rhizome, with outer cortical layers often partially or completely removed, yielding not less than 2 p. c. non-volatile ether-soluble extractive nor 12 p. c. cold water extractive.

Habitat. India, Hindustan (cultivated in W. Indies, Africa).

Syn. Zingib., Jamaica, Black, African or Race Ginger; Fr. Gingembre (gris et blanc); Ger. Rhizoma (Radix) Zingiberis, Ingwer.

Zin′gi-ber. L. fr. Skt. *gringavera—gringa*, horn, + *vera*, body, horn-shaped—*i. e.*, shape of roots; Ar., Pers. *zanjabil zenjebil*; Eng. *ginger.*

Of-fi-ci-na′le. L. *officina*, workshop; *opus*, work, + *facere*, to do—*i. e.*, used in the shop or store.

Plant.—Perennial herb; stem barren, leafy, 1–1.3 M. (3–4°) high, entirely covered with the leaf-sheaths, solid; round: leaves 15–30 Cm.

ZINGIBERACEÆ

(6–12′) long, 2.5–4 Cm. (1–1$\frac{3}{5}$′) wide; flowering stalk from stem 15–30 Cm. (6–12′) long, terminating in a spike; flowers dingy yellow, 2–3 at a time. RHIZOME: *Jamaica*, horizontal, cork wholly removed, laterally compressed, irregularly branched, 4–16 Cm. (1$\frac{3}{5}$–6$\frac{2}{5}$′) long, 4–20 Mm. ($\frac{1}{6}$–$\frac{4}{5}$′) thick, light brown, longitudinally striate, ends of branches with depressed stem-scars; fracture short-fibrous; starchy, resinous; internally yellowish, light brown; odor agreeably aromatic; taste aromatic, pungent; *Cochin*, most of corky layer removed on flattened sides, light brown, grayish-yellow; fracture shorter, less fibrous more starchy than other varieties; internally yellowish-white, oil and resin cells, yellowish,

FIG. 61.—Zingiber: *A*, entire plant ($\frac{1}{4}$ nat. size); *B*, flower; *C*, labellum; *D*, transverse section of ovary.

FIG. 62.—Jamaica ginger; uncoated.

brownish-red; odor aromatic; taste pungent; *African*, cork partly removed on flattened sides, areas without cork smooth, light brown, portions with cork longitudinally or reticulately wrinkled and grayish-brown; fracture short-fibrous; internally light yellow, brown; odor strongly aromatic; taste aromatic, strongly pungent, otherwise resembling Jamaica. POWDER, light yellow (Jamaica), light brown (Cochin), light brown, (African)—numerous starch grains .005–.04 Mm. ($\frac{1}{500}$–$\frac{1}{625}$′) broad, nearly spherical, ovoid, elliptical, pyriform, hilum excentric near smaller end, fibers long, non-lignified, oblique pores, occasional cells with brownish resin-like contents; tracheæ; yellowish, brownish cork cells, thin-walled, occasional in Jamaica, fairly numerous

in Cochin and African. *Solvents:* alcohol; acetone; ether; boiling water partially. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—RHIZOME: Fibrous, light, friable, worm-eaten pieces (all discarded); POWDER: Rice starch, flour, curcuma, brick-dust, chalk, capsicum, mustard (detected by microscope, iodine T. S., ash), "spent ginger"—that partially or wholly exhausted.

Commercial.—Plant reed-like, is propagated by rhizome segments, thrives best on new forest soil, and yields when one or more years old (the younger the better) very acceptable rhizomes, which are dug after the stems have withered, Jan.–Feb., cleaned carefully to avoid bruising, hence discoloration, washed in boiling water to hydrate starch and prevent germination, and then rapidly dried, constituting as such *black, coated, unpeeled, unscraped ginger*, in contradistinction to the further prepared *white, uncoated, peeled, scraped, race, hand ginger*—the former, owing to most oil and resin residing in the periderm, being richer and stronger. May bleach artificially by sulphur fumes (SO_2), chlorinated lime (Cl), milk of lime, or gypsum. There are several varieties, three being given pharmacopœial prominence: 1, *Jamaica*, sometimes steeped in milk of lime, and covered with calcium carbonate, thereby preventing insect attack; least pungent, most delicate and handsome; reaches us via England, or direct from W. Indies; 2, *Cochin* (*Chinese*), resembles somewhat the Jamaica, but seldom enters our market commercially; 3, *African*, generally recognized as possessing greater pungency but less acceptable aroma than the preceding, with shorter rhizome and broadly linear or oblong lobes; yields 8–10 p. c. of oleoresin; 4, *Calcutta* (*E. India*), resembles closely the African; reaches us via Calcutta; yields 8 p. c. of oleoresin; 5, *Calicut* (*E. India*), resembles closely the African; reaches us from Calicut; yields 8 p. c. of oleoresin; 6, *Japanese*, resembles closely the Cochin, and seldom becomes a commercial article with us. The *green* (lobed branches recently dug and marketed without drying), and *preserved* (fresh rhizome steeped in hot syrup, becoming soft, brownish, translucent, efflorescent) are popular trade forms.

FIG. 63.—Calcutta ginger; coated.

CONSTITUENTS.—Volatile oil 1–3 p. c., Gingerol .5–1.5 p. c., Resin (2), starch 20 p. c., mucilage, ash 4–8 p. c.

Volatile Oil.—Mostly phellandrene, $C_{15}H_{24}$, and *d*-camphene $C_{10}H_{16}$; thickish, greenish-yellow; sp. gr. 0.885; gives aromatic odor and flavor, but not the pungency.

Gingerol.—Not a glucoside, but a straw-colored, viscid, inodorous, non-volatile, pungent liquid, imparting the hot taste; soluble in fat, benzene, carbon disulphide, volatile oils, alcohol, ether.

ZINGIBERACEÆ

PREPARATIONS.—*Fluidextractum Zingiberis.* Fluidextract of Ginger. (Syn., Fldext. Zingib., Fluid Extract of Ginger; Fr. Extrait fluide de Gingembre; Ger. Ingwerfluidextrakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126; menstruum: alcohol. Dose, ♏v–20 (.3–1.3 cc.).

Preps.: 1. *Syrupus Zingiberis.* Syrup of Ginger. (Syn., Syr. Zingib.; Fr. Sirop de Gingembre; Ger. Ingwersirup.)

Manufacture: 3 p. c. Mix fluidextract of ginger 3 cc. and alcohol 2, triturate liquid with magnesium carbonate 1 Gm., sucrose 6, gradually add, constantly triturating, water 43 cc., filter, dissolve in clear filtrate, gently heating, sucrose 76 Gm., strain syrup (hot), when cold add through strainer water q. s. 100 cc. Dose, ʒss–2 (2–8 cc.).

2. *Elixir Hydrastis Compositum, N. F.*, .875 p. c.

2. *Tinctura Zingiberis.* Tincture of Ginger. (Syn., Tr. Zingib., Tincture of Jamaica Ginger; Fr. Teinture de Gingembre; Ger. Ingwertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: 85 p. c. alcohol. *Impurities:* Capsicum, similar pungent substitutes. Dose, ♏xx–60 (1.3–4 cc.).

Prep.: 1. *Acidum Sulphuricum Aromaticum*, 5 p. c.

3. *Pulvis Rhei Compositus*, 10 p. c. 4. *Pulvis Aromaticus, N. F.*, 35 p. c. 5. *Pulvis Aromaticus Rubefaciens, N. F.*, 20 p. c. 6. *Pulvis Myricæ Compositus, N. F.*, 30 p. c. 7. *Tinctura Antiperiodica, N. F.*, $\frac{1}{13}$ p. c. 8. *Tinctura Aromatica, N. F.*, 4 p. c.

Unoff. Preps.: Infusion, 5 p. c., ʒj–2 (30–60 cc.). *Oleoresin* (ether)—yield 5–10 p. c., ♏ss–2 (.03–.13 cc.).

FIG. 64.—Ginger starch granules: magnified 250 diam.

PROPERTIES.—Like other aromatics, carminative, stimulant, sternutatory, rubefacient, anodyne, sialagogue. This was introduced from Asia, through Arabia into Greece and Europe. The Arabian and Greek physicians used it as a condiment, carminative, stimulant, aphrodisiac.

USES.—Atonic dyspepsia, flatulent colic, atonic gout, diarrhea, cholera, chronic bronchitis, alcoholic gastritis, corrective to nauseous medicines. Externally—colic, rheumatism, neuralgia, toothache, headache; in cataplasms, fomentations. The infusion for relaxed uvula, masticated for paralysis of tongue. *Zingiber Zerum'bet*, Java (rhizome fleshy, spongy, ginger odor and taste), and *Z. Cassumu'nar*, India (root 5 Cm. (2′) long, fleshy radicles, white tubers, scaly, brown; odor and taste camphoraceous)—both used in their respective countries. *Z. Mio'ga*, cultivated in China, Japan—bergamot taste, slightly pungent.

Allied Plants:

1. *Alpin'ia officina'rum, Galanga, Galangal, N. F.*—The dried rhizome with not more than 2 p. c. of foreign organic matter, yielding not more than 3 p. c. of acid-insoluble ash; China, cultivated. Per-

ennial flag-like herb; flowers terminal racemes, white, red-veined. Rhizome, irregularly branched, 2–10 Cm. ($\frac{4}{5}$–4′) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick, branches with annuli of lighter-colored leaf bases, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}$′) apart, rusty brown, internally orange-brown, cut end of branches circular and expanded; fracture fibrous; odor aromatic, agreeable; taste hot, spicy, ginger-like. Powder, reddish-brown—numerous starch grains, oil cells and reddish resin cells, tracheæ with thickenings, pores, thick-walled fibers, no lignified tissue; contains volatile oil .5 p. c., resin, gum, bassorin, fat, galangol, galangin, kæmpferid, alpinin, starch 23 p. c. Stimulant, aromatic, carminative; improve digestion, relieve flatulence. Dose, gr. 5–20 (.3–1.3 Gm.); 1. *Tinctura Aromatica,* 2 p. c.

Fig. 65.—Galanga.

Fig. 66.—Turmeric rhizome and stem.

ZINGIBERACEÆ

2. *Cur'cuma Zedoa'ria, Zedoaria, Zedoary, N. F.*—The dried rhizome with not more than 2 p. c. of foreign organic matter; India, largely cultivated. Perennial reed-like plant. Rhizome (tuber) occurs as *long* and *round*, varying in size, 12–37.5 Mm. ($\frac{1}{2}$–$1\frac{1}{2}'$) long, usually cut into transverse rounded sections, twisted, wrinkled, 1–4 Cm. ($\frac{2}{5}$–$1\frac{3}{5}'$) broad, 5–10 Mm. ($\frac{1}{5}$–$\frac{2}{5}'$) thick, grayish-brown, hairy, rough, few root-scars, transverse surface brownish, dark circular endodermis separates cortex from central cylinder; stele with yellowish resin cells, lighter fibro-vascular bundles, fewer in cortex; fracture short, mealy, waxy; odor aromatic, camphor-like; taste aromatic, warm, bitter. Powder, brownish—numerous starch grains and thick-walled hairs, parenchyma, few bast-fibers; no calcium oxalate crystals or stone cells; contains volatile oil .5–1 p. c., resin (pungent taste), starch, mucilage, ash 7 p. c. Stomachic, aromatic, stimulant; dyspepsia, flatulence—weaker than ginger. Dose, gr. 10–30 (.6–2 Gm.); 1. *Pilulæ Antiperiodicæ*, $\frac{1}{8}$ gr.; 2. *Tinctura Amara*, 2 p. c. 3. *Tinctura Antiperiodica*, $\frac{1}{5}$ p. c.

FIG. 67.—Curcuma starch.

2. *Cur'cuma lon'ga, Turmeric.*—The rhizome, U. S. P. 1820–1870; S. Asia, Indian Ocean Islands. Plant is a perennial; leaves radical, 1 M. (3°) long, lanceolate; flower-scape short, spike 15 Cm. (6′) long, flowers orange-yellow, in pairs; rhizome 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}'$) thick (long turmeric) to 18–25 Mm. ($\frac{3}{4}$–$1'$) thick (round turmeric), sometimes in sections, yellowish-gray, annulate, inside orange-yellow, fracture resinous; odor ginger-like; taste warm, aromatic; contains volatile oil 1 p. c., viscid oil 11 p. c., pungent resin, curcumin (coloring matter) .3 p. c., starch, ash 5–7 p. c. Powder deep yellow, brownish-red by alkalies or borax. There are several varieties: 1, Madras (best, bright yellow, often in cut pieces—Pubna preferred); 2, Bengal (reddish, mostly round); 3, Java (reddish-gray); 4, Chinese (often branched); 5, Cochin (possibly from *C. viridiflo'ra*). Used as stimulant, tonic, aromatic, condiment, for jaundice, and as ginger; Tincture, 15 p. c., (diluted alcohol) for coloring ointments, solutions, etc.

CARDAMOMI SEMEN. CARDAMOM SEED, *U.S.P.*

Elettaria Cardamomum, *Maton.* { The dried ripe seed, recently removed from the capsules, yielding not more than 5 p. c. acid-insoluble ash.

Habitat. Malabar, cultivated. India, Mountains, 750–1,500 M. (2,500–5,000°) elevation; Ceylon, Annam, Siam.

Syn. Cardam. Sem., Cardamomum, U.S.P. 1900, Malabar, Ceylon or Bastard Cardamom; Br. Cardamomi Semina, Cardamom Seeds, Cardamomum (Minus) Malabari (am)-cum; Fr. Cardamomes, Petit Cardamome; Ger. Fructus (Semen) Cardamomi (Minoris), Malabar-(Malabarische) Kardamomen, Kleine Kardamomen.

El-et-ta'ri-a. L. fr. *Elettari—i. e.*, native name of plant in Malabar.

Car-da-mo'mum. L. fr. Gr. κάρδος, thistle, + ἄμωμος, blameless, classic name.

PLANT.—Perennial herb; stems green, 2–4 M. (6–12°) high, tapering, shining, covered with leaf-sheaths; leaves .3–.8 M. (1–$2\frac{1}{2}$°) long,

FIG. 68.—*Elettaria Cardamomum: A*, leaf with ligule, *b; B*, bracts; *C*, flower, natural size: *D*, flower with calyx and corolla-tube partially removed; *E*, *F*, *G*, capsule form; *H*, seed with arillus, *a; J*, cross-section of seed 8 times enlarged; *K*, longitudinal section 5 times enlarged; *p*, perisperm; *em*, embryo; *e*, endosperm.

2.5-12.5 Cm. (1–5′) broad, lanceolate, flower stalk from stem base lies on the ground; flowers, in rainy season, Jan.–May, greenish-

ZINGIBERACEÆ

white; rhizome tuberous, woody, fibrous roots below, scars above; fruit capsule, ellipsoidal, triangular, 10–20 Mm. ($\frac{2}{5}$–$\frac{4}{5}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, pale buff, striate, 3-locular, pericarp thin, leathery, nearly tasteless. SEED, 10–20, mostly agglutinated into groups of 2–7 by adhering membranous aril, oblong-ovoid, irregularly 3–4-sided, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}$′) long; convex on dorsal surface, strongly longitudinally grooved on ventral side, coarsely tuberculated, reddish-gray brown; odor aromatic; taste aromatic, pungent. POWDER, brownish—endosperm and perisperm cells filled with starch grains .001–.004 Mm. ($\frac{1}{250}$–$\frac{1}{625}$′) broad, or with 1-more calcium oxalate prisms, fragments of seed-coat and spiral tracheæ, few bast-fibers. Seed constitute 75 p. c. of the fruit, keep best in the pericarp, from which they should only be removed just prior to using. *Solvents:* diluted alcohol; boiling water. Dose, gr 5–15 (.3–1 Gm.).

ADULTERATIONS.—SEED: Rare—those of various varieties and allied species taken from the pericarp; ENTIRE FRUIT—with orange seed, green coffee, etc.; POWDER: Starch, sodium carbonate, ginger (recognized by its larger starch grains), etc.

FIG. 69.—Malabar cardamom: *a*, short; *b*, medium; *c*, long.

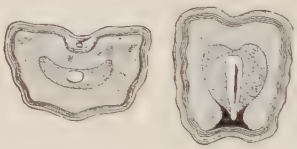


FIG. 70.—Cardamom seed: transverse and longitudinal section, magnified 5 diam.

Commercial.—Plant grows wild but mostly by cultivation in Malabar (W. Mysore) and Ceylon, on spaces cleared in mountain forests affording shade, or on betel-nut plantations, and yields the fourth year and many thereafter. Fruit is gathered mostly in dry weather, Oct.–Dec., preferably prior to maturity to minimize splitting, then dried artificially on tiers of trays in curing houses (brownish), or better in the sun, guarding against rain and excessive heat exposure, that cause the moist seed to swell and rupture pericarp (yellowish); the slower the drying, the less the splitting. Bleaching is effected by exposing to sulphur fumes, or to dew and sunlight, the finest by washing with alternating solutions of lathery soap-berry and astringent acacia pods, finally drying in the sun. Value is determined by size, color, plumpness, smoothness (the best being creamy white, smooth, silky) and are assorted through sieves into 4 kinds: (*a*) *Shorts*, 12 Mm. ($\frac{1}{2}$′) long, 6 Mm. ($\frac{1}{4}$′) broad, plump, heavy; (*b*) *Mediums*, 18–25 Mm. ($\frac{3}{4}$–1′) long, 6 Mm. ($\frac{1}{4}$′) broad, paler buff, finer ribbed; (*c*) *Longs*, 25–31 Mm. (1–1$\frac{1}{4}$′) long, 4 Mm. ($\frac{1}{6}$′) broad, rarely imported; (*d*) *Tiny*, least desirable. There are several varieties: 1, *Mysore* (*Ceylon-Mysore*, *Alleppi*), shorts, best, bleached and unbleached (greenish), exported from Alleppi,

Calicut; 2, *Malabar*, shorts, mediums, high grade, preferred by some, exported from Ceylon, India (Bombay), brown, striated; 3, *Madras*, usually mediums, pale buff, exported from Madras, Pondicherry; 4, *Mangalore;* 5, *Ceylon Mangalores*, round, valuable. The *Ceylons* are the wild-grown fruits of Ceylon, and the *Siam* of Cochin, Annam, Tonquin (Tonking) combined; the shorts of all varieties are best and most desired; imported in chests, 60–100–200 pounds (27–46–91 Kg.). The shelled seed, deteriorating rapidly, should never be used.

CONSTITUENTS.—Volatile oil 5 p. c., fixed oil 10 p. c., potassium salts 2.5 p. c., starch 3 p. c., nitrogenous mucilage 1.8 p. c., yellow coloring matter .4 p. c., ligneous fiber 77.3 p. c., manganese .8 p. c., ash 6–8–15 p. c.

Oleum Cardamomi, *N.F.*—This volatile oil (mostly in the testa) distilled from the seed, is a colorless, pale yellow liquid, characteristic, aromatic, penetrating, somewhat camphoraceous odor of cardamom, and persistent, pungent, strongly aromatic taste; soluble in alcohol, 70 p. c. alcohol (4), sp. gr. 0.935, dextrorotatory; contains terpinene, $C_{10}H_{16}$, possibly dipentene, a body of the composition $C_{10}H_{18}O$ (terpineol?), acetic and formic acids; also extracted by ether, giving a more durable oil mixed with fixed oil, this latter being easily separated. The distilled oil readily deteriorates, and should be kept cool, dark, in small well-stoppered, amber-colored bottles.

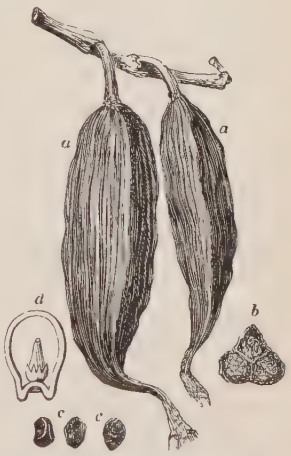


FIG. 71.—Ceylon cardamom: *a*, capsules; *b*, transverse section of capsule; *c*, seed; *d*, section of seed with embryo; magnified.

PREPARATIONS.—SEED: 1. *Tinctura Cardamomi.* Tincture of Cardamom. (Syn., Tr. Cardam.; Fr. Teinture de Cardamome; Ger. Kardamomentinktur.)

Manufacture: 15 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol. Dose, ʒj–2 (4–8 cc.).

2. *Tinctura Cardamomi Composita.* Compound Tincture of Cardamom. (Syn., Tr. Cardam. Co.; Fr. Teinture de Cardamome composée; Ger. Zusammengesetzte Kardamomentinktur.)

Manufacture: 2 p. c. Macerate, for 3 or more days, with frequent agitation, in a stoppered container, in a moderately warm place, cardamom seed 2 Gm., cinnamon 2.5, caraway 1.2, cochineal .5, with 75 cc. of mixture of glycerin 5 cc. + diluted alcohol 95, finishing with diluted alcohol q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

Preps.: 1. *Elix. Euphorb. Co., N.F.*, 5 p. c. 2. *Elix. Gentian. Glycerin., N.F.*, 6 p. c. 3. *Elix. Tarax. Co., N.F.*, 3 p. c. 4. *Elix. Viburn. Prun., N.F.*, 7.5 p. c. 5. *Syr. Eriodict. Arom., N.F.*, 6.5 p. c.

3. *Extractum Colocynthidis Compositum*, 5 p. c. 4. *Tinctura Gentianæ Composita*, 1 p. c. 5. *Tinctura Rhei*, 3 p. c. 6. *Pulvis Aromaticus,*

ZINGIBERACEÆ

N.F., 15 p. c. 7. *Pulvis Cretæ Aromaticus, N.F.*, 2 p. c. 8. *Tinctura Aromatica, N.F.*, 2 p. c. 9. *Tinctura Rhei Dulcis, N.F.*, 1 p. c. OIL: 1. *Spiritus Cardamomi Compositus, N.F.*, 10 p. c.

Preps.: 1. *Elixir Cardamomi Compositum, N.F.*, 1 p. c. 2. *Elixir Gentianæ, N.F.*, 1.5 p. c. 3. *Elixir Glycerophosphatum Compositum, N.F.*, $\frac{1}{5}$ p. c. 4. *Elixir Glycyrrhizæ Aquosum, N.F.*, $\frac{1}{2}$ p. c. 5. *Liquor Pancreatini, N.F.*, .35 p. c.

2. *Spiritus Vanillini Compositus, N.F.*, 1 p. c.

Unoff. Preps.: Fluidextract. Infusion, 5 p. c., ʒj-2 (30–60 cc.).

PROPERTIES.—Carminative, stomachic, stimulant, aromatic, condiment.

USES.—Adjuvant or corrective to cordials, tonics, purgatives, flavoring liquors, cakes, breath, etc.

Allied Plants:

1. *Elettaria ma'jor, Ceylon Cardamom.*—About 40 Mm. ($1\frac{3}{5}'$) long, triangular, prolonged into a beak 15 Mm. ($\frac{3}{5}'$) long, brownish-gray color.

2. *Amo'mum Cardamo'mum, A. ve'rum* and *A. globo'sum, Round Cardamom.*—Siam, Java, China, globular-ovate. *A. aromat'icum, Bengal Cardamom,* 9-winged at apex. *A. xanthoi'des, Wild* or *Bastard Cardamom, A. max'imum, Java Winged Cardamom,* 9–12-winged from base to apex, and *A. Gra'num-paradi'si, Grain of Paradise.* Fruit resemble cardamom seed, several varieties, used for ginger.

FIG. 72.—Maranta starch.

FIG. 73.—Canna starch.

3. *Maran'ta arundina'cea, Arrow-root.*—The fecula of the rhizome, U. S. P. 1820 1870; W. Indies, Bermudas, Brazil. Plant slender, 1–2 M. (3–6°) high, leaves 7.5–12.5 Cm. (3–5′) long, lanceolate, flowers white, rhizome perennial, tuberous, fleshy, scaly, 15–30 Cm. (6–12′) long. Arrow-root in powder or lumps 4 Mm. ($\frac{1}{6}'$) thick, white, opaque; under microscope consists of oval granules of fine-lined layers, nucleus at broad end. The rhizome when 1–2 years old is dug, washed, deprived of scales, ground under water, kneaded, strained, and the fecula allowed to subside; fresh rhizome yields starch 13–20 p. c.; root contains starch 27 p. c., fat .2 p. c. Used as demulcent, nutritive food for infants, convalescents, bowel or urinary troubles; in 5 p. c. solution

with water or milk by boiling and flavoring with vanilla, lemon juice, etc.; also used in puddings. The jelly is more tenacious than that of all other starches, except Canna.

4. *Can'na ed'ulis, Canna (Tous-les-mois).*—The fecula of rhizome, U.S.P. 1860–1870; Peru, Brazil. Perennial herb 2.5 M. (8°) high; stem green; leaves parallel-veined, bluish-green; flowers few, in pairs, red; yellow, purple, bract; fruit round capsule, 12 Mm. ($\frac{1}{2}'$) thick; rhizome creeping, fleshy, thick joints. Canna starch white powder, satiny; under microscope granules largest of all, potato coming next, $\frac{1}{1\,2}$—$\frac{1}{8}$ Mm. ($\frac{1}{3\,0\,0}$—$\frac{1}{2\,0\,0}'$) long, flat, ovate, hilum at narrow end, encircled by many unequally distant rings. Grind rhizome under water, knead, strain, allow to subside. Used as demulcent, nutritive food for urinary and bowel affections, infants, invalids in convalescence.

11. ORCHIDACEÆ. Orchid Family.

Or-ki-da'se-e. L. *Orchi(s)d* + aceæ, fr. Gr. *ὄρχις*, a testicle—*i. e.*, ancient name from shape of roots. Herbs, shrubs, terrestrial or epiphytical. Distinguished by flowers being perfect, irregular, reptile-shape, perianth 6, in 2 whorls, petaloid, superior; leaves sheathing, entire; anthers 1–2, sessile, united to style (gynandrous); pollen cohering in masses; ovary 1-celled, inferior, long, 3-angled; capsule 3-valved; universal; aromatic, antispasmodic, nutrient, aphrodisiac, flavoring, beautiful flowers.

Genus: **1. Vanilla.**

VANILLA. VANILLA, *N.F.*

Vanillinum. Vanillin, $C_8H_8O_3$, *U.S.P.*

Vanilla planifolia, *Andrews.* { Methylprotocatechuic aldehyde occurring naturally in vanilla (cured fruit), or prepared synthetically.

Habitat. E. Mexico, hot, damp woods, forests; cultivated in tropics.

Syn. Vanilla Aromatica, Vaniglia; Fr. Vanille, Vanilline; Ger. Fructus (Siliqua) Vanillæ, Vanillin.

Va-nil'la. L. fr. Sp. *vainilla,* formerly *vaynilla,* dim. of *vaina (vayna),* scabbard, sheath, pod, lit. "little pod"—*i. e.*, pod resembling the sheath of a knife.

Pla-ni-fo'li-a. L. *planus,* flat, + *folium,* leaf, flat-leaved—*i. e.*, leaves plain or flat, without prominent veins.

PLANT.—Succulent, dark green, epiphytic, terrestrial or parasitic, perennial climber; stem long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}'$) thick, smooth, much branched, nodes with aërial roots and rootlets, 12.5–15 Cm. (5–6′) long, for clinging to trees, frame-work, etc., leaves 10–15 Cm. (4–6′) long, oval, tough, fleshy, veinless, dark green, paler beneath; flowers 5 Cm. (2′) broad, pale yellowish-green, loose axillary racemes of 8–10. Fruit (pod). Vanilla, Vanilla Bean, *N.F.*—The cured full-grown,

unripe fruit, preserved in a cool place where it will not become brittle, when it should not be used. It is linear, flattened, tapering, 12–35 Cm. (5–14′) long, 5–9 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) broad, in clusters of 3–15, flat circular scar at summit, curved (hooked) at base (Tahiti variety — middle broad, tapering similarly towards either end), blackish-brown, longitudinally wrinkled, moist-glossy, occasionally with efflorescence of vanillin acicular crystals, and 3-divided near tip; frequently cork patches; flexible, tough, 1-celled, blackish-brown pulp and many triangular, reticulate seed, .25–.30 Mm. ($\frac{1}{100}$—$\frac{1}{75}$′) broad; odor and taste characteristic, very agreeable. *Test:* 1. Efflorescent crystal on slide, + 1 drop of phloroglucinol T. S. and hydrochloric acid—carmine-red (dist. from benzoic acid); solvent: 75 p. c. alcohol. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 74.—*Vanilla planifolia.*

Commercial: Plant mostly cultivated, since 1850, from cuttings, sometimes seed, in Papantla, Misantla, Vera Cruz, Oaxaca provinces, where moisture is abundant and temperature never below 18° C. (65° F.); it climbs by rhizoids (non-absorbing roots), pollinates by

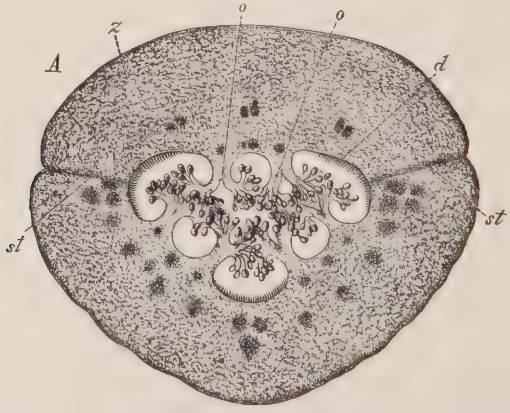


FIG. 75.—Vanilla fruit, cross-section magnified: *z*, fruit flesh; *st*, opening suture; *o*, seed placentæ; *d*, papillæ.

insects, hand; bears fruit 3d year, continues 30–40; fruit (cured, full-grown, unripe) develops in 2–3 months, but a longer time is required

for maturing, and when collected (late autumn before quite ripe, as green begins disappearing into yellow, to avoid splitting) is placed in heaps, sheltered from sun and rain, to undergo partial fermentation and shriveling, then followed by the process of "sweating"—exposure to sun or stove heat (60° C.; 140° F.) until a fine chestnut-brown color is acquired, and the odorous principle, vanillin, has been developed from the normal coniferin (secreted by the internal hair-like fibrillæ), which is converted by hydrolization into glucose and coniferic alcohol, then this latter by an oxydase into vanillin—the object being to drive moisture out upon the surface and finally drying the latter; the process may be aided by the sweating-box, steaming, wrapping in blankets, etc.; they now are dried by a 2-months' exposure to the sun, then coated with oil (that which exudes, also cocoa and cashew nut), tied in small bundles of 50–75, wrapped in foil, and marketed; by insufficient drying, to retain weight, the interior of beans and wherever tied sometimes become moldy. There are several varieties: 1, *Mexican* (*Vera Cruz*), best, but beans vary much in value; 2, *Bourbon*, from Isle of Réunion, resembles Mexican, but beans blacker, tapering portion shorter, less firm and fleshy, surface smooth, waxy, soon becoming coated with acicular crystals (frost); odor more like Tonka bean; 3, *Mauritius* (*Seychelles*), often sold as inferior Bourbon; beans only 15 Cm. (6′) long, 6 Mm. ($\frac{1}{4}$′) broad, pale color, smooth, not waxy, faint odor; 4, *South American* (*Guadeloupe*), resembles Mexican, but broader, flatter, often 12 Mm. ($\frac{1}{2}$′) broad, reddish-brown, odor of fermented molasses, pulpy, resinous, few crystals on surface, beans often open and seed on the surface; 5, *Tahiti*, transplanted Mexican; beans 15 Cm. (6′) long, 12 Mm. ($\frac{1}{2}$′) broad, reddish-brown, heliotrope odor; 6, *Java*, mostly consumed in Holland, beans 10–15 Cm. (4–6′) long, fine flavor of Mexican but odor much more powerful; 7, *Vanillons* (*Brazilian* —*V. Pompo'na*), larger, thicker than S. American, inferior vanilla odor (heliotrope), used by perfumers, tobacconists; contains vanillin .5 p. c. Beans also are imported from Honduras, Madagascar, Martinique, etc., while some occur on the market deprived by a solvent of vanillin, and others to which benzoic acid, etc., have been added; all may be purchased as "splits" and "cuts."

CONSTITUENTS.—FRUIT: Vanillin (Mexican 1.7 p. c., Bourbon 2 p. c., Java 2.75 p. c., in the 2 last associated with odorous oil), fixed oil 11 p. c., balsam, resin, sugar, mucilage, tannin, oxalic acid, ash 4–6 p. c.

Vanillinum. Vanillin.—This is obtained (1) by crushing the pods (fruit) with sand, extracting with ether in a Soxhlet tube, shaking out ethereal extract with sodium sulphite solution, liberating vanillin from this by treating with sulphuric acid, expelling sulphurous acid generated, extracting with ether; (2) by slowly adding a concentrated solution of coniferin, $C_{16}H_{22}O_8$, from cambium sap of pines, to a warm solution of potassium dichromate in water and sulphuric acid, finally heating to boiling for 3 hours—coniferin, by hydrolysis from action

of acid, is converted into dextrose and coniferyl alcohol, and this latter oxidizes into vanillin and aldehyde: $C_{16}H_{22}O_8 + H_2O = C_6H_{12}O_6 + C_{10}H_{12}O_3$; $C_{10}H_{12}O_3 + O = C_8H_8O_3 + C_2H_4O$—passing steam through mixture, or adding successive portions of ether, filtering, reclaiming ether, when vanillin crystallizes; (3) by boiling eugenol, $C_{10}H_{12}O_2$, with acetic anhydride, forming acetyl-isoeugenol, $C_{10}H_{11}(C_2H_3O)O_3$, which is oxidized with potassium dichromate into acetyl-vanillin—the latter upon treating with potassium hydroxide solution and concentrating being converted into vanillin, which may be removed by acidulating filtrate with sulphuric acid and shaking out with ether; this method, owing to economic reasons, is used chiefly. It is in fine, white, slightly yellowish, needle-like crystals, odor and taste of vanilla, 400 times stronger than the pod, soluble in alcohol, chloroform, ether, glycerin (20), water (100), hot water (16), aqueous solutions of alkali hydroxides, from which it is precipitated by acids; melts at 81° C. (178° F.); incinerate—ash .05 p. c.; aqueous solution acid, optically inactive. *Tests:* 1. Aqueous solution with ferric chloride T. S.—blue color, changed to brown on boiling, and on cooling—white precipitate (dihydrodivanillin). 2. Shake ethereal solution with saturated aqueous solution of sodium bisulphite, add sulphuric acid—vanillin precipitated. 3. Cold aqueous solution with lead acetate T. S.—white precipitate (lead compound of vanillin), soluble in hot water. 4. Warm .1 Gm. with concentrated alcoholic solution of sodium hydroxide, + a drop of chloroform, warm—no odor of phenylisocyanide (abs. of acetanilid). *Impurities:* Acetanilid, benzoic acid, boric acid, terpin hydrate, coumarin, 50–90 p. c. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

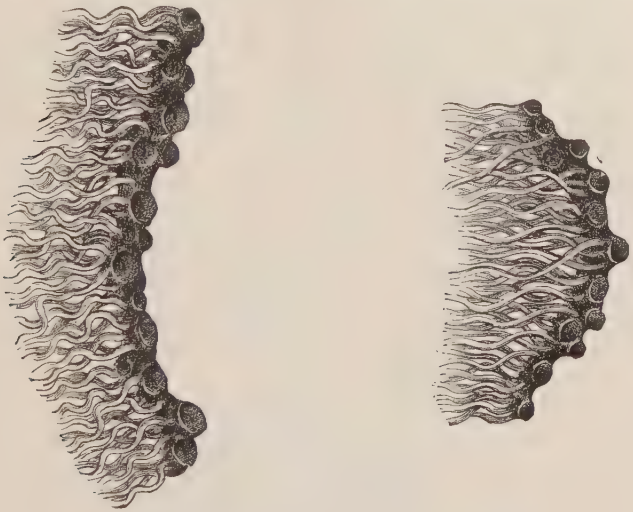
PREPARATIONS.—1. FRUIT: 1. *Tinctura Vanillæ, N.F.,* 10 p. c. + sucrose 20 (1st menstruum alcohol, 2d diluted alcohol): Preps.: 1. *Elixir Ammonii Valeratis, N.F.,* 1.6 p. c. 2. *Emulsum Olei Ricini, N.F.,* 2.5 p. c. 3. *Syrupus Bromidorum, N.F.,* 3.2 p. c. 4. *Syrupus Cacao, N.F.,* $\frac{1}{5}$ p. c. 5. *Tabellæ Santonini, N.F.,* $\frac{1}{4}$ ℳ. 6. *Tabellæ Santonini Compositæ, N.F.,* $\frac{1}{4}$ ℳ. II. VANILLIN: 1. *Spiritus Vanillini Compositus, N.F.,* 20 p. c.: Prep.: 1. *Elixir Vanillini Compositum, N.F.,* 20 p. c. 2. *Elixir Amygdalæ Compositum, N.F.,* $\frac{1}{10}$ p. c. 3. *Liquor Ferri Peptonati, N.F.,* $\frac{1}{500}$ p. c. 4. *Liquor Ferri Peptonati et Mangani, N.F.,* $\frac{1}{500}$ p. c. 5. *Oleum Ricini Aromaticum, N.F.,* $\frac{1}{10}$ p. c.

PROPERTIES.—Carminative, stimulant, aphrodisiac, antihysteric, irritant. Those working in it have itching hands, face, neck (the skin being covered with pruriginous eruptions), dizziness, weariness, muscular pains; eruptions due to an *acarus* which does not enter the skin.

USES.—The Spanish conquerors found vanilla in use in Mexico for flavoring chocolate, etc., and while now recommended for hysteria, it is employed chiefly as a flavoring agent, being the most general of all substances; large quantities may produce poisonous symptoms. *Vanilla Pompo'na,* Guadeloupe variety, *V. Gardne'ri,* Brazilian and Bahia, *V. odora'ta, V. phœan'tha,* Jamaica, Trinidad—used similarly.

Allied Plants:

1. *Cypripe'dium bulbo'sum, C. pubes'cens, C. parviflor'um, Cypripedium, Lady Slipper Root, N. F.*—The dried rhizome and roots with



a *b*

Fig. 76.—*a, Cypripedium hirsutum (pubescens):* rhizome and roots, natural size. *b, Cypripedium parviflorum:* rhizome and roots, natural size.

not more than 3 p. c. of other parts, or other foreign organic matter, yielding not more than 6 p. c. of acid-insoluble ash; N. America, woods, swampy places. Perennial hairy herbs, .3–.6 M. (1–2°) high; leaves ovate, 10–12.5 Cm. (4–5′) long; flowers bright yellow, showy, 4-divided, moccasin-shaped; hairs irritant—cutaneous eruptions. Rhizome curved, 3–10 Cm. ($1\frac{1}{5}$–4′) long, 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) thick, orange-brown, brownish, many cup-shape scars above, and wavy roots below, 3–15 Cm. ($1\frac{1}{5}$–6′) long, fracture short (roots fibrous); odor distinct, heavy; taste sweetish, bitter, pungent. Powder, yellowish-brown—numerous starch grains, calcium oxalate raphides, tracheæ, few tracheids, thin-walled and thick-walled fibers, epidermal tissue, parenchyma cells with starch, resin, or calcium oxalate; solvents: boiling water, diluted alcohol; contains volatile oil, resin (2), fixed oil, volatile acid, tannin. Antiperiodic, nervous stimulant, diaphoretic; cholera, hysteria, epilepsy, nervousness, hypochondriasis, neuralgia, insomnia—substitute for valerian. Dose, gr.

Fig. 77.—*Orchis mascula.*

PIPERACEÆ

15–30 (1–2 Gm.): 1. *Fluidextractum Cypripedii* (diluted alcohol), dose, ℥xv–30 (1–2 cc.); "Eclectic" resinoid, cypripedin, gr. 1–2 (.06–.13 Gm.).

2. *Or'chis mas'cula* (+ other species), *Salep.*—The fecula of the root, U.S.P. 1820; C. and S. Europe; rich woods. Small herb 15–45 Cm. (6–18′) high, leaves parallel-veined, sheathing; flowers pinkish, showy, nectariferous spur underneath, root (tubers) consists of 2 fleshy tubers 2.5 Cm. (1′) long, deprived of epidermis by scalding in water; yellowish-brown, hard, translucent, horny, insipid; contains starch 27 p. c., mucilage 48 p. c.; starch obtained by grinding root under water, straining, subsiding. Demulcent, nutritive diet for infants, children, chronic diarrhea, cholera infantum, tuberculous diarrhea, in mucilage (1 part + water 50). *Adulterations.*—TUBERS: Colchicum corm, this latter being recognized by its side groove and sweet, bitter, acrid taste; POWDER: Starch, flour, which can readily be distinguished by microscope. Dose, *ad libitum.*

SUB-CLASS 2. **DICOTYLEDONES (Embryo with 2 cotyledons, stem exogenous (with pith, wood, bark), leaves net-veined).**

SERIES 1: **CHORIPETALÆ. Petals separate and distinct, or wanting.**

12. PIPERACEÆ. Pepper Family.

Pip-e-ra'se-e. L. *Piper* + aceæ, Gr. *πίπερι*, Skt. *pipala*, Bengalese *pippul*, fr. Gr. *πέπτω*, to digest—*i. e.*, it aids digestion. Herbs, shrubs. Distinguished by jointed stems; leaves entire; flowers perfect, without floral envelopes, spikes; ovary 3–5, somewhat united, 1-celled; ovule 1, stigma 2–4; fruit somewhat fleshy, 1-celled, 1-seeded; tropics; acrid, pungent, aromatic, stimulant (volatile oil + resin).

Genus: **1. Piper.**

CUBEBA. CUBEB, *U.S.P.*

Piper Cubeba, *Linné filius,* **(Cubeba Cubeba,** (*Linné filius*) *Lyons*).

The dried, nearly full-grown, unripe fruit, with not more than 5 p. c. shriveled fruits or stems nor 2 p. c. foreign organic matter, yielding not less than 10 p. c. volatile ether-soluble extractive.

Habitat. Java, Sumatra, Borneo; cultivated in two former islands, and in W. Indies, Ceylon.

Syn. Cubeb, Cubebs, Tailed Cubebs, Cubeb-, Java-, or Tailed-Pepper; Br. Cubebæ Fructus (Baccæ), Piper Caudatum; Fr. Cubèbe, Poivre à Queue; Ger. Cubebæ, Kubeben.

Pi'per. L. see etymology, above, of Piperaceæ.

Cu-be'ba. L. fr. Gr. *κουβέβα*, of Actuarius; name used since the 10th century; Pers. *kababa*, their native name of the plant.

PLANT.—Climbing woody perennial; stem jointed, flexuous, 6 M. (20°) high; leaves 15 Cm. (6′) long, lanceolate, leathery, shining,

nerved, petiolate; flowers dicœcious, spikes, 2.5–5 Cm. (1–2′) long. FRUIT, upper portion globular, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, abruptly contracted into a slender, stem-like portion (stipe, thecaphore—not a true pedicel, but stigma remnant), 5–7 Mm. ($\frac{1}{5}$–$\frac{1}{4}$′) long; pericarp brown, dark brown, rarely gray, coarsely reticulate, .3 Mm. ($\frac{1}{75}$′) thick; 1-locular, 1-seeded, the seed attached at base of pericarp, usually not completely filling loculus; odor aromatic, characteristic; taste strongly aromatic, pungent. POWDER, brown—numerous starch grains, .002–

FIG. 78.—*Piper Cubeba.*

.012 Mm. ($\frac{1}{1250}$–$\frac{1}{2000}$′) broad, and stone cells with yellowish porous walls; few wood bundles with spiral tracheæ and fibers; with sulphuric acid against white background—crimson-red. *Solvents:* ether; alcohol. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—FRUIT: Rachis or stalks (inodorous, increasing fibro-vascular tissue and ash), partially grown fruit, siftings (darker and without starch masses), black pepper and other piperaceous fruits (*P. cani'num*, *P. cras'sipes*, *P. Lo'wong*, *P. mollis'simum*, *P. ribesoi'des*, *P. Clu'sii*, *Sit'sea citra'ta*, etc.), all distinguished by character-

istic shape, odor, and taste. *Rhamnus cathartica* fruit (pedicellate and contains 4 seed), allspice (much larger, 2-seeded, no pedicel). *Juniperus communis* fruit (much larger, different taste); POWDER: Deteriorates unless kept in tight containers, hence best to powder only when needed, sometimes mixed with powdered allspice, flour, or starch.

Commercial.—Plant grows extensively in coffee plantations or on grounds reserved for the purpose, being supported usually on shade trees; fruit is gathered when full-grown, but before ripe—still of a green color—dried carefully in the sun, and exported from Java to Singapore, whence it enters market.

CONSTITUENTS.—Volatile oil 5–15 p. c., Resin 2.5–3.5 p. c., Cubebin .4–3 p. c., Cubebic acid 1–3.5 p. c., fixed oil 1 p. c., gum 8 p. c., starch, ash 5–8 p. c. (cubeb stalks 10 p. c.).

Oleum Cubebæ. Oil of Cubeb.—This volatile oil, distilled with water or steam from the unripe fruit, is a colorless, pale green, yellowish-green liquid, characteristic odor and taste of cubeb, sp. gr. 0.915, levorotatory, soluble in equal volume of alcohol, neutral reaction; contains a little dipentene, $C_{10}H_{16}$, but mostly sesquiterpene, cadinene, $C_{15}H_{24}$. If old, or distilled from old fruit, has additionally an inodorous stearoptene, cubeb camphor, $C_{15}H_{24}.H_2O$, which soon deposits. Dose, ♏v–20 (.3–1.3 cc.).

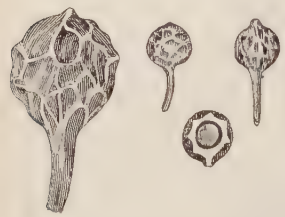


FIG. 79.—Cubeb: fruit, natural size, and magnified.

Resin.—Extracted by ether, which also takes up volatile oil, fixed oil, cubebin, chlorophyll, and wax; evaporate off volatile oil, when cold cubebin and wax deposit; decant from these, separate fat and have left the resin, which is amorphous, soluble in alkalies, alcohol, not precipitated by alcoholic solution of lead acetate.

Cubebin, $C_{10}H_{10}O_3$.—This constitutes the precipitate from oleoresin upon standing; it is white, crystalline, inodorous, inert; alcoholic solution bitter.

Cubebic Acid, $C_{14}H_{16}O_4$.—Brownish, resin-like mass, soluble in alkalies, alcohol, ether, chloroform, precipitated by lead acetate; diuretic. Dose, gr. 5–10 (.3–.6 Gm.). Last three are red with sulphuric acid.

PREPARATIONS.—1. *Fluidextractum Cubebæ, N.F.* (alcohol), dose, ♏xv–60 (1–4 cc.). 2. *Oleoresina Cubebæ, N.F.* (alcohol); on standing deposits waxy crystalline precipitate—must use only liquid portion, dose, ♏v–30 (.3–2 cc.). 3. *Tinctura Cubebæ, N.F.*, 20 p. c. (alcohol), dose, ʒss–2 (2–8 cc.). 4. *Fluidextractum Buchu Compositum, N.F.*, 12.5 p. c. 5. *Pilulæ Antiperiodicæ, N.F.*, $\frac{1}{8}$ gr. 6. *Tinctura Antiperiodica, N.F.*, $\frac{1}{5}$ p. c.

Unoff. Preps.: Extract, gr. 2–10 (.13–.6 Gm.). *Infusion*, 5 p. c., ℥j–2 (30–60 cc.). *Troches* (each $\frac{1}{3}$ gr. oleoresin).

PROPERTIES.—Diuretic (resin + cubebic acid), stimulant, carminative, expectorant, disinfectant, local irritant (volatile oil), may cause

headache, giddiness, nausea, purging, paralysis; it is eliminated by bronchial mucous membrane, skin, and kidneys, all being stimulated and the increased secretions disinfected; imparts to urine a peculiar odor.

USES.—Gonorrhea, urethritis, vesical irritability, cystitis, abscess of prostate gland, piles, chronic bronchitis, catarrh. Arabians used it similarly to black pepper, and were the first to introduce it into Europe.

Allied Products:

1. *Piper Lo'wong* (*Cubeba Lowong*) and *P. ribesoi'des* (*C. Wallich'ii*), fruit of both much like the official.

2. *P. cani'num* (*C. canina*), fruit smaller than official, contracted below into a stalk half the length of the globular portion, and *P. cras'sipes* (*C. crassipes*), fruit larger than the official.

3. *False Cubeb.*—Origin unknown, fruit wrinkled, brownish-gray, size of the official, stalk 5 Mm. ($\frac{1}{5}'$) long, odor mace-like.

Allied Plants:

1. *Piper ni'grum, Piper, Pepper, Black Pepper, N. F.*—The dried, unripe fruit with not more than 2 p. c. of stems or other foreign matter, yielding not less than 6 p. c. of non-volatile extract, soluble in ether; S. Asia; cultivated. Perennial woody, evergreen climber; leaves 10–15 Cm. (4–6′) long, ovate, entire, smooth, leathery, dark green, 5–7-nerved; flowers, spikes, whitish. Fruit, berry-like—green, red, yellow (ripe), nearly globular, 3.5–6 Mm. ($\frac{1}{7}$–$\frac{1}{4}'$) broad, epicarp thin, easily separable from sarcocarp, grayish-black, coarsely reticulate, unilocular, 1-seeded, seed nearly white, hollow, adhering to pericarp; odor aromatic, slightly empyreumatic; taste aromatic, very pungent. Powder, grayish-black—fragments of pericarp—blackish-brown, of perisperm and embryo—whitish, starch grains, stone cells (epicarp) with reddish-brown pigment, or (endocarp) with reddish-brown substance; oil cells with yellowish oil that may separate piperine prisms; solvents: ether, acetone, alcohol, water partially; contains piperine 5–8 p. c., piperidine .56 p. c., volatile oil 1–2 p. c., resin (pungent), chavicin, piperic acid, starch 25–45 p. c., fixed oil 7 p. c. The commercial *oil of black pepper* (Oleum Piperis), a by-product in making piperine, consists of the volatile oil, fixed oil, and pungent

FIG. 80.—*Piper nigrum.*

PIPERACEÆ

resin—practically the oleoresin. Stimulant, tonic, antiperiodic, carminative, rubefacient; intermittents, colic, indigestion, flatulence; gargle for throat; gums; plaster for rheumatism; universal condiment. There are several varieties: 1, Malabar—heaviest; 2, Penang—strongest; 3, Singapore—darkest; 4, Straits Settlements—chief and best; the first three suitably mixed furnish popular trade brands. *Adulterations.*—FRUIT: That of allied species, stalks, siftings, grape seeds, ivory nut, cinnamon, mace. POWDER: starch, flour, mustard, husks, flaxseed, capsicum—all recognized by microscope. Dose, gr. 5–20 (.3–1.3 Gm.); 1. *Tinctura Antiperiodica*, $\frac{1}{3}\frac{1}{0}$ p. c. *Oleoresin*, 5–6.5 p. c., ♏ss–2 (.03–.13 cc.). *Fluidextract*, ♏v–20 (.3–1.3 cc.).

FIG. 81.—Matico: natural size.

2. *P. angustifo'lium*, *Matico*, *N. F.*—The dried leaf with not more than 5 p. c. of stems, flower spikes or other foreign organic matter, yielding not more than 6 p. c. of acid-insoluble ash; S. America—Andes of Peru, Bolivia. Large soft-wooded shrub or small tree; branches quadrangular, the younger hairy; flowers small, yellowish; fruit small, hard, black, 1-seeded; leaves, usually broken in compressed, matted masses, 10–20 Cm. (4–8′) long, 2–5 Cm. ($\frac{4}{5}$–2′) broad, lanceolate, acute, unequal cordate, crenulate, dark green above, tessellated, pale green below, reticulate with prominent midrib and veins, quadrangular-meshed, pubescent; odor distinct, aromatic; taste pungent, pepper-like. Powder, greenish-yellow—non-glandular hairs, epidermal cells with stomata, secretion cells; solvents: alcohol (50–75 p. c.), boiling water; contains volatile oil 2–3 p. c., artanthic acid, pungent resin, bitter principle, tannin, mucilage—maticin is only a potassium salt. Stimulant, tonic, diuretic, styptic, vulnerary, aphrodisiac (similar to cubeb—mostly due to volatile oil); bronchitis, gonorrhea, menorrhagia, hemorrhoids, diarrhea, dysentery, hematuria, hemorrhage, vesical catarrh, incontinence of urine; locally to bleeding surfaces, owing to the many hairs promoting blood-clot. *Adulterations:* Leaves of allied species of its own genus, and those of *Eupato'rium* and *Walthe'ria* genera—none being tessellated above or rough and hairy beneath. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Matico* (75 p. c. alcohol), dose, ♏xv–60 (1–4 cc.). *Infusion*, 5 p. c., ℥j–2 (30–60 cc.); *Tincture*, 10 p. c., ℥j–2 (4–8 cc.).

3. *P. methys'ticum, Kava, Methysticum, Kava Kava, N. F.*—The dried rhizome and roots with not more than 1 p. c. of foreign organic matter; Sandwich Islands; cultivated. Tall, soft-wooded herb. Rhizome, irregular knotty crown, 12 Cm. (5′) thick, from which radiate many tough roots with ends separating fibro-vascular bundles, sometimes cut into angular pieces; crown soft, light, spongy, granular, starchy, dark brown—crown, lighter where scraped, internally white; odor faint, characteristic; taste aromatic, pungent, bitter—more or less anesthesia. Powder, whitish—starch grains, yellow resin and oil cells, sclerenchymatous fibers, tracheæ with markings, parenchyma cells (stem); solvent: diluted alcohol; contains resins (alpha-, beta-) 2 p. c., yangonin, kavaine, methysticin (kavahin—resembles piperine), volatile oil, starch 50 p. c., ash 8 p. c. Local anesthetic—lasts several days, but too irritating for general use; on mucous membranes—tingling sensation then anesthesia; natives prepare a beverage *kava,* by fermenting infusion which produces drowsiness, mutterings, weakness of limbs, without impairing intelligence. Diuretic; cystitis, vaginitis, acute and chronic diarrhea, leucorrhea. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Kavæ* (60 p. c. alcohol).

4. *P. officina'rum (lon'gum), Long Pepper.*—The immature fruit dried in the sun, U.S.P. 1830; Java, India, Ceylon, Philippine Islands, Bengal. Shrub like *P. nigrum;* leaves cordate; flowers spikes; fruit spike-like cone 2.5–4 Cm. (1–1$\frac{3}{5}$′) long, 5 Mm. ($\frac{1}{5}$′) thick, cylindrical, uneven, dusty, blackish-gray, the many coalesced fruits spirally arranged, each crowned with style remnant; odor, taste, properties, and composition like that of *P. nigrum.* The Bengal long pepper is darker and shorter (2.5 Cm.; 1′ long) than that from elsewhere.

5. *P. al'bum, White Pepper.*—The ripe fruit of *P. nigrum* deprived of the pericarp from which it separates easily, and may be facilitated by gathering spikes, cleaning, immersing in water, and rubbing with the hands in baskets. It is somewhat larger than the *black,* smooth, yellowish, hard, horny, mealy within, odor and taste similar but less powerful. There are four varieties: 1, Tellicherry; 2, Penang; 3, Batavia; 4, Singapore. Largely used in China. Still another variety is made by soaking off (or using mechanical means) the outer portion (pericarp) of black pepper, or simply drying the very young and immature fruit, but this is smaller and inferior. *Adulterations:* Same as in *black.*

6. *P. Famecho'ni, Kissi, Kissine, Guinea Pepper;* Upper Guinea. Fruit in cylindrical clusters—small blackish-brown, ovoid berries, each with cubeb-like pedicle at base; aromatic odor, agreeable taste; contains volatile oil 4.5–11.5 p. c., piperine 3.5–5 p. c. Used like pepper.

7. *P. Be'tel.*—India. Climbing plant; leaves chewed by the Malays with lime and areca-nut shavings. *P. Carpun'ya,* Chile, Peru; small tree. *P. pelta'tum, P. umbella'tum;* Tropical America. Diuretic; skin diseases, tumors.

RECAPITULATION TABLE NO. 1—U.S.P. DRUGS AND PREPARATIONS.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Gelidiaceæ:								
1. Agar.	Gelidium corneum.	Dried mucilaginous substance.	Pacific, Atlantic Oceans.	Gelose, mineral salts, water.	.....	Demulcent, nutrient, aperient.	Culture media, constipation.	Grains. 60–240 (4–15 Gm.).
2. Agar.								
Hypocreaceæ:								
1. Ergota.	Claviceps purpurea.	The dried sclerotium.	Russia, Spain.	Ergotoxine, parahydroxyphenylethylamine, tyramine, histamine, ergamine, fixed oil, scleromucin.	Fluidextract.	Emmenagogue, ecbolic, hemostatic, excitomotor, poisonous.	In labor, dysmenorrhea, polypi, amenorrhea, hemorrhages, hemorrhoids.	15–60 (1–4 Gm.).
2. Ergot.								
Polypodiaceæ:								
1. Aspidium.	Dryopteris Filix-mas.	The rhizome and stipes.	N. America, N. Asia, Europe.	Filicic acid, filicin, fixed oil, filitannic acid, vol. oil, resin.	Oleoresin.	Teniafuge.	Tape-worms.	30–120 (2–8 Gm.).
2. Aspidium.								
Lycopodiaceæ:								
1. Lycopodium.	Lycopodium clavatum.	The spores.	Europe, Asia, N. America.	Fixed oil, cane-sugar (sucrose), volatile base (methylamine).	.....	Diuretic, antispasmodic; rheumatism, epilepsy, pulmonary, renal disorders.	Externally: erysipelas, eczema, herpes, ulcers, chafing, to prevent pills and suppositories adhering.	Externally.
2. Lycopodium.								
Pinaceæ (Coniferæ):								
1. Oleum Terebinthinæ.	Pinus palustris +.	Volatile oil.	N. America.	Pinene, $C_{10}H_{16}$.	*Oil:* Rectl. oil, terebene, terpin hydrate, emul., canthar. cerate. *Resin:* ros. cer., canth. cer., pine tar.	Stimulant, anthelmintic, hemostatic, expectorant, antiseptic, diuretic, rubefacient.	Bronchitis, catarrh, cystitis, urinary troubles, hemorrhages, erysipelas, pneumonia, rheumatism, renal colic, sprains.	Minims. 5–30 (.3–2 cc.).
2. Oil of Turpentine.								
1. Resina.	.....	Resin.	.....	Abietic, pinic and sylvic acids.				
2. Rosin.								
1. Oleum Pini Pumilionis.	Pinus montana.	Volatile oil.	C. Europe.	Pinene, phellandrene, sylvestrene.	.....	Antirheumatic, expectorant, stimulant, antiseptic.	Rheumatism, bronchitis, laryngitis.	1–5 (.06–.3 cc.).
2. Oil of Dwarf Pine Needles.								
1. Oleum Juniperi.	Juniperus communis.	Volatile oil.	N. America.	Pinene, $C_{10}H_{16}$, cadinene, $C_{15}H_{24}$.	.....	Stimulant, diuretic, anodyne, antiseptic, emmenagogue.	Renal dropsy, vesical catarrh, rheumatism, swellings.	5–15 (.3–1 cc.).
2. Oil of Juniper.								
1. Oleum Cadinum.	Juniperus Oxycedrus.	Volatile oil.	S. Europe.	Phenols, cadinene, $C_{15}H_{24}$.	.....		Psoriasis, pityriasis rubra, eczema.	3–5 (.2–.3 cc.).
2. Oil of Cade.								
Graminaceæ:								
1. Amylum.	Zea Mays.	The granules from the grain.	.....	$(C_6H_{10}O_5)_3$	Glycerite, diluent in extracts, glucosum, etc.	Nutritive, demulcent.	Allays itching, urticaria, erysipelas, inflamed rectum, protective.	Grains. 30–120 (2–8 Gm.).
2. Starch.								
1. Sucrosum.	Saccharum officinarum.	The juice evaporated and crystallized.	S. Asia.	$C_{12}H_{22}O_{11}$.	Syrup, many troches and medicated syrups, pills, powders, etc.	Demulcent, lenitive, laxative, ulcerations.	Vehicle, corrigent, preservative, antiseptic, excipient, coughs, ascarides, ulcers, wounds, eye troubles.	Ad libitum.
2. Sucrose.								

1. Maltum. 2. Malt.	Hordeum vulgare.	The partially germinated grain dried.	W. Asia, China.	Diastase, peptase, hordenine, dextrose, sugar, starch.	Extract.	Nutritive, laxative, demulcent.	Dyspepsia, phthisis, wasting diseases, emulsifying agent.	Ad libitum.
Melanthaceæ: 1. Veratrum Viride. 2. Veratrum Viride.	Veratrum viride.	The dried rhizome and roots.	N. America.	Protoveratrine, jervine, rubijervine, pseudojervine, cevadine, resin—veratroidine.	Tincture.	Sedative, emetic, diaphoretic, errhine.	Arterial excitement, spinal spasms, pneumonia, heart troubles, convulsions, tetanus, chorea, mania.	1–4 (.06–.26 Gm.).
1. Colchici Cormus. 2. Colchicum Corm. 1. Colchici Semen. 2. Colchicum Seed.	Colchicum autumnale.	The dried corm. The dried seed.	C. and S. Europe, N. Africa.	Colchicine, colchiceine, colchicoresin, starch, sugar, fixed oil.	Extract. Fluidextr., tincture.	Alterative, cathartic, emetic, sedative, diuretic, diaphoretic.	Gout, rheumatism, skin affections, prurigo, urticaria, neuralgia.	2–8 (.13–.5 Gm.). 1–5 (.06–.3 Gm.).
Liliaceæ: 1 Aloe. 2. Aloe.	Aloe: Perryi, vera, ferox.	The inspissated juice.	E. Africa, Socotra, W. Indies, Curaçao, Cape of Good Hope.	Aloin, resin, emodin, volatile oil.	Pills, extr. coloc. co., tr. benz. co.	Cathartic, drastic, emmenagogue, vermifuge.	Costiveness, jaundice, hemorrhoids, amenorrhea, ascarides.	½–10 (.03–.6 Gm.).
1. Scilla. 2. Squill.	Urginea maritima.	The inner bulb scale.	Mediterranean Basin.	Scillitin, sinistrin, sugar, Ca oxalate.	Vinegar, syrup, fluidextr., comp. syrup, tincture.	Expectorant, cardiac stimulant, diuretic, emetic, cathartic, irritant.	Croup, coughs, bronchitis, asthma, dropsies, whooping-cough.	1–5–10 (.06–.3–.6 Gm.).
Smilaceæ: 1. Sarsaparilla. 2. Sarsaparilla.	Smilax: medica, officinalis, ornata.	The dried root.	Trop. America, Mexico.	Sarsasaponin, parillin, smilasaponin, volatile oil, resin, starch, Ca oxalate.	Fluidextr., comp. syr., comp. fluidextract.	Alterative, diuretic, diaphoretic, tonic.	Blood purifier in scrofula, skin diseases, syphilis, abscesses, ulcers.	30–120 (2–8 Gm.).
Zingiberaceæ: 1. Zingiber. 2. Ginger.	Zingiber officinale.	The dried rhizome.	India, Africa, Hindustan.	Volatile oil, gingerol, resin, starch, mucilage.	Fluidextr., syrup, tinct., ac. sulph. ar., pulv. rhei comp.	Carminative, stimulant, sternutatory, rubefacient, sialagogue.	Dyspepsia, diarrhea, cholera, bronchitis, rheumatism, toothache, headache, colic.	5–20 (.3–1.3 Gm.).
1. Cardamomi Semen. 2. Cardamom Seed.	Elettaria Cardamomum.	The dried seed.	Malabar, India.	Volatile oil, fixed oil, starch, salts.	Tinct., tinct. co., ext. colocyn. co., tr. gent. co., tr. rhei.	Carminative, stimulant, aromatic, condiment.	As adjuvant or corrective to cordials, tonics, purgatives, flavoring.	5–15 (.3–1 Gm.).
Orchidaceæ: 1. Vanillinum. 2. Vanillin.	Vanilla planifolia.	Methylprotocatechuic aldehyde.	E. Mexico.	$C_8H_8O_3$.	.....	Carminative, stimulant, aphrodisiac, irritant.	Hysteria, flavoring agent.	⅙–½ (.01–.03 Gm.).
Piperaceæ: 1. Cubeba. 2. Cubeb.	Piper Cubeba.	The dried nearly full-grown unripe fruit.	Java, Sumatra, Borneo, W. Indies.	Volatile oil, resin, cubebin, cubebic acid, fixed oil.	.....	Diuretic, stimulant, carminative, irritant.	Gonorrhea, cystitis, bronchitis, catarrh, vesical irritability.	15–60 (1–4 Gm.).

13. SALICACEÆ. Willow Family.

Sal-i-ka'se-e. L. *Sali(x)c* + aceæ, willow, from Celtic *sal*, near, + *lis*, water—*i. e.*, its favored place of growth; or L. *salire*, to leap—its rapid growing. Trees, shrubs. Distinguished by light wood, bitter bark, alternate, stipulate leaves, diœcious flowers, both kinds in catkins, 1 to each bract, no perianth; fruit 1-celled, 2–4-valved pod, many-seeded, each with long silky hairs at one end, but covering it; ovary 1-celled, superior; stamens 2 or more; temperate climates; tonic, astringent, febrifuge, stimulant; timber, basket-making, seed hair for cushions.

Genera: **1. Salix. 2. Populus.**

SALIX. SALIX (Willow).

Salicinum. Salicin, $C_{13}H_{18}O_7$, *U.S.P.*

Salix and **Populus,** several species. } A glucoside.

Habitat. Europe, N. America; cultivated.

Syn. White Willow, Common European-, Duck-, Huntington-, Salicin Willow, Withe, Withy; Fr. Saule blanc, Salicine; Ger. Weidenrinde, Salicin.

Sa'lix. L. see etymology, above, of Salicaceæ.

Pop'u-lus. L. poplar, fr. *populus*, the people—being often planted along the public ways in Rome, where it was called *arbor populi*, tree of the people.

Plants.—These two juxta-positioned genera are composed mostly of large trees 15–18 M. (50–60°) high, with flexible branches: *Salix* leaves, long pointed, entire or glandularly toothed; *Populus* leaves, broad, more or less heart-shaped, ovate, toothed; flowers May, both in catkins appearing before the leaves, diœcious, buds covered with scales, or a varnish; barks of both genera resemble; that of *Salix* slips from the wood more readily.

Constituents.—Salicin 1–3 p. c., tannin 12 p. c., extractive matter.

Salicinum. Salicin.—Obtained by several methods: 1. Add litharge or basic lead acetate to hot concentrated decoction of young bark to remove tannin, gum, extractive; the filtrate contains salicin and some absorbed lead, the latter is separated by adding sulphuric acid and barium sulphide, while salicin, upon concentration of the filtrate, crystallizes out. When basic lead acetate is used, the free acid should be neutralized with calcium carbonate, and then the filtrate evaporated. 2. Boil bark with milk of lime to remove tannin, evaporate filtrate to soft extract, digest this with alcohol, from which salicin will crystallize after distilling off the alcohol. It is in colorless, silky, shining, needles or prisms, white, crystalline powder, odorless, very bitter taste, soluble in water (23.5), hot water (3.3), alcohol (88.5), hot alcohol (30), insoluble in chloroform, ether; aqueous solution (1 in 30) neutral, levorotatory, melts at 200° C. (392° F.). *Tests:* 1. Heat small portion in test-tube until brown, add distilled water (few cc.), + a drop of ferric chloride T. S.—violet color. 2. With sulphuric acid—red color, disappearing on adding distilled water; incinerate—ash .05 p. c.

3. Heat gently .1 Gm. with potassium dichromate .2 Gm. + diluted sulphuric acid 2 cc.—fragrant odor of salicylic aldehyde. 4. Aqueous solution (1 in 50) 10 cc., + 1 cc. tannic acid T. S., picric acid T. S., or mercuric potassium iodide T. S.—no precipitate (abs. of alkaloids; another 10 cc., + a drop of ferric chloride T. S.—not violet (abs. of salicylic acid). *Impurities:* Heavy metals, alkaloids, salicylic acid. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

Commercial.—The *White Willow* (*Salix al'ba*) and *Crack Willow* (*S. frag'ilis*) contain most tannin, the *Purple Willow* (*S. purpu'rea*) most salicin, it being even in the leaves, although largest quantity in bark of young wood. *Populus al'ba, P. angustifo'lia, P. acumina'ta, P. trem'ula,* all yield salicin to a considerable extent.

FIG. 82. — Willow bark: transverse section, magnified 15 diam.

PREPARATIONS.—(Unoff.): May give in powder, pill, syrup, water, or with glycyrrhiza extract, in small and frequent doses.

PROPERTIES.—Tonic, antiperiodic, antipyretic, antiseptic, antiferment, non-toxic; slower, weaker, less depressing to heart than salicylic acid, like it—circulates in the blood as sodium salicylate; converted in stomach into glucose and saligenin, eliminated by urine as saligenin, salicylic, salicyluric, salicylous acids.

USES.—Acute rheumatism, fevers; relieves pain, arterial swellings, intermittents (inferior to quinine), coryza, hay fever, influenza, neuralgia, diabetes. Externally—gangrenous wounds, eczema, cancer, burns, fetid perspiration—applied in solution with borax.

Allied Plants:

1. *Populus ni'gra, P. can'dicans,* or *P. balsamif'era, Populi Gemmæ, Balsam Poplar Buds, Balm of Gilead Buds, N. F.* The air dried, closed, winter leaf-buds with not more than 10 p. c. of flower buds, yielding not more than 1 p. c. of acid-insoluble ash; United States, Canada. Large tree. Buds conical, pointed, up to 2 Cm. ($\frac{4}{5}'$) long, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}'$) thick, consisting of closely imbricated scales, brown, glossy, glutinous with fragrant resin; internally with abundant oleoresin and salicin crystals; odor pleasant, balsamic; taste aromatic, bitter; contains volatile oil, resin. Stimulating expectorant, antinephritic, antirheumatic, tonic; bronchitis, nephritis, catarrh, rheumatism; ulcers—ointment. Dose, gr. 15–30 (1–2 Gm.); 1. *Syrupus Pini Albæ Compositus,* 1 p. c.: Prep.: 1. *Syrupus Pini Albæ Compositus cum Morphina.*

2. *Myri'ca cerif'era,* or *M. carolinen'sis, Myrica, Bayberry Bark, Wax Myrtle Bark, N. F.*—Myricaceæ. The dried bark of the root with not more than 5 p. c. of adhering wood or other foreign organic matter; S. United States; dry woods, fields. Dense evergreen shrub, 1.5–3 M. (4.5–9°) high, grayish; leaves oblong, entire, fragrant, dark green; flowers, staminate—yellow catkins, pistillate—greenish aments; fruit, bluish-white drupes, waxy. Bark (root) in transversely

curved pieces, strips, quills, varying length, up to 20 Mm. ($\frac{4}{5}'$) broad, 1–2.5 Mm. ($\frac{1}{25}$–$\frac{1}{10}'$) thick, rarely 5 Mm. ($\frac{1}{5}'$—aërial stem), grayish, brownish, scaly, occasional warts, lenticels, inner surface brownish, striated; fracture short, weak, uneven; odor characteristic; taste astringent, bitter, acrid. Powder, reddish-brown—numerous starch grains, calcium oxalate crystals, lignified fibers, stone cells, gummy lignin, few tracheæ; contains resins, myricinic acid, tannin, red coloring, fat, gum, starch. Alterative, cholagogue, diuretic, sialagogue, astringent, tonic; diarrhea, scrofula, jaundice. Dose, gr. 5–30 (.3–2 Gm.); 1. *Pulvis Myricæ Compositus, Composition Powder,* 60 p. c. + ginger 30, capsicum 5, clove 5—stimulant, carminative. Dose, gr. 10–20 (.6–1.3 Gm.). *Extract,* gr. 5 (.3 Gm.).

FIG. 83.—Juglans: flowering branch; cross-section of fruit.

3. *Ju'glans cine'rea, Juglans, Butternut Bark, N.F.*—Juglandaceæ. The dried inner bark of the root, with not more than 2 p. c. of adhering wood or other foreign organic matter; United States, Canada. Handsome spreading tree, 9–15 M. (30–50°) high, light gray bark, durable brown wood; leaves imparipinnate; flowers—staminate and pistillate; fruit large, oblong drupe, 6 Cm. ($2\frac{2}{5}'$) long, hairy, viscid, green then brown; seed thick, oily, edible. Root-bark (liber) in quills, curved strips, chips, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}'$) thick, deep brown throughout, outer surface smooth, warty, inner surface smooth, striate; fracture short, weak; odor faintly aromatic; taste bitter, astringent, acrid. Powder, dark brown—calcium oxalate rosette crystals, starch grains, stone cells, sometimes with reddish content, crystal-fibers, tannin, oily drops; contains juglandic acid (juglone, nucin—oxynaphtoquinone), fixed oil 14 p. c., volatile oil, resin, tannin, ash 8 p. c. Cathartic (resembling rhubarb), mild hepatic stimulant; malaria, chronic constipation, dysentery. Dose, 5j–2 (4–8 Gm.); 1. *Fluidextractum Juglandis* (1st menstruum: glycerin 10, alcohol 50, water 40; 2d diluted alcohol): Prep.: 1. *Elixir Cascaræ Sagradæ Compositum,* 6.5 p. c. Juglandin ("Eclectic" resinoid), gr. 3–10 (.2–.6 Gm.).

J. re'gia, English Walnut.—Persia, Himalayas, China, cultivated, Europe. Decoction of leaves used in leucorrhea, meningitis; decoction of leaves, rind, or bark in checking mammary secretion, ulcers, diarrhea, sore mouth, tonsils, uterine hemorrhages, carbuncles. *J. ni'gra, Black Walnut.*—Bark styptic, acrid; used mostly in dyeing. The rind of green fruit removes ringworms, tetter, diphtheria. Decoction used as a vermifuge; spirit made by distilling fresh walnuts with alcohol; used in hysteric, cerebral, and pregnant vomiting. All of these fruits contain much fixed oil, which turns red with nitric acid, but brown with nitric and sulphuric acids.

4. *Bet'ula al'ba, White Birch.*—Betulaceæ; *Oleum Betulæ Empyreumaticum Rectificatum, Rectified Oil of Birch Tar, N.F.* The pyroligneous oil obtained by dry distillation of the bark and wood, rectified by steam distillation; Europe, Asia, N. America. Large handsome tree. Oil is a limpid, dark brown liquid; odor penetrating, empyreumatic—resembling Russia leather; soluble in ether, chloroform, glacial acetic acid, amyl alcohol, oil of turpentine, benzene, carbon disulphide, dehydrated alcohol (3); mixed with alcohol (3) or purified petroleum benzene (3)—slight turbidity, but with methyl alcohol—decided turbidity, sp. gr. 0.918; aqueous filtrate 4 cc., + a drop of dilute ferric chloride solution (1 in 100)—green coloration, then brown, turbid (dist. from oil of cade); contains guaiacol, creosol, cresol, xylecrol, phenol. Antiseptic, counter-irritant; sore and stiffened muscles, joints; 1. *Unguentum Resorcinolis Compositum,* 6 p. c. *B. len'ta, Sweet Birch*—is one of the sources (bark) of U.S.P. Methyl Salicylate, see page 460; *B. papyrif'era, Paper (Canoe) Birch, White Birch;* Canada, New York, has cordate leaves, tough white bark which separates into papery layers, and was used by the Indians in making canoes.

14. FAGACEÆ (CUPULIFERÆ). Beech Family.

Fa-ga'se-e. L. *Fag-us* + aceæ, fr. Gr. *φαγεῖν*, to eat, *φαγός*, the beech—*i. e.*, in allusion to the esculent nuts once used as food. Trees, shrubs. Distinguished by alternate irregular leaves; fruit in a bur or cupule—pistillate involucre; flowers monœcious, staminate, aments, stamens 5–20, pistillate, spikes 1–3, or scaly catkins, involucre; petals none; ovary inferior, 2–6-celled, ovules 1–2 in each cell; fruit 1-seeded nut; temperate climates, tropics; astringent, seeds edible, valuable timber.

Genus: **1. Quercus.**

GALLA. NUTGALL, *U.S.P.*

Quercus infectoria, *Olivier,* and other allied species. } The gall from the young twigs.

Habitat. Mediterranean Basin, eastward; Greece, Persia, Asia Minor, Syria.

Syn. Gall, Aleppo Galls, Smyrna Galls, Turkey or Mecca Galls, Galls, Oak Warts, Mad-, Oak-, or Dead Sea-Apple, Apple of Sodom, Dyers' Oak, Galla Halepense-, Turcica-, Levantica-, Tinctoria-, Quercina; Fr. Galle d'Alep—de Chêne, Noix de Galle; Ger. Gallæ, Galläpfel, Gallen.

Quer'cus. L. oak, fr. Celtic *quer,* fine + *cuez,* a tree—fine, stately tree; or fr. Gr. *χοῖρος,* a pig—*i. e.,* pigs love and feed on the acorns.

In-fec-to'ri-a. L. *infectorius,* dyeing, staining; *in,* in + *facere,* to do, make, taint—*i. e.,* species easily infected or stung, thereby yielding dyeing product.

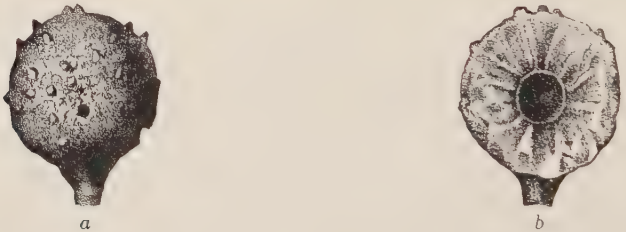
Gal'la. L. for *gall,* fr. Eng. *gallen,* galled = chafed, as a horse, or from its gallish taste.

PLANT.—Polymorphous shrub, 1.3–2 M. (4–6°) high; leaves obovate, shallow rounded lobed, 5–7.5 Cm. (2–3′) long; flowers May, catkins;

FAGACEÆ

fruit Sept., acorn, 2.5–4 Cm. (1–1⅗′) long. NUTGALL (excrescence) nearly globular, .8–2.5 Cm. (⅖–1′) broad, heavy, mostly sinking in water, olive-green, dark grayish, tuberculated above; basal portion smooth, contracted to short stalk; fracture short, horny; internally grayish, dark brown, with a central radiate portion, occasionally a central cavity connected by narrow radial canal to exterior, odor slight taste strongly and persistently astringent. POWDER, brownish-yellow—starch grains up to .03 Mm. (⅛$\frac{1}{0\,0}$′), few stone cells with narrow cavities and branched pore-canals; occasionally reticulate tracheæ, tannin masses, calcium oxalate prisms and rosettes. *Solvents:* alcohol; water. Dose, gr. 5–30 (.3–2 Gm.).

Commercial.—Plant differs from *Q. alba*, *N.F.*, in seldom being tree-like, in having less indented leaves, larger acorns, and dissimilar cupules. The leaf-buds and tender bark of shoots are stung (punctured) easily by the horny ovipositors of the female hymenopterous insects (*Cyn'ips tincto'ria*) which deposit one or more eggs in such galled places (wounds), and thereby establishes morbid growth that quickly leads



a *b*

FIG. 84.—Galla: *a*, entire; *b*, vertical section.

to the formation of a small tumor of hypertrophied tissue enclosing the egg; upon the gall reaching full development the egg hatches into a larva or grub that at once begins feeding on juices of the central cavity, which, never larger than the larva, soon becomes lined with a wall of hard cells that gradually extend to the periphery, causing the gall to harden. The grub when grown passes into the pupa (chrysalis) stage, thence into a 4-winged fly, 6 Mm. (¼′) long, that must either die or cut itself out with its mandibles, thus making a small round opening midway the gall; should this not be accomplished the insect remains will be revealed upon cracking open the unpunctured gall. Color is the guide to quality—the whitish, light, and spongy being rejected. There are several varieties: 1, *Aleppo* (*Syrian*), best, bluish, usually collected before the fly escapes; 2, *Smyrna*, grayish-olive, intermixed with white galls (least valuable, generally with large perforation); 3, *Sorian*, blackish, size of a pea; all three varieties exported from Trebizond, Smyrna, Bassora, Calcutta, Bombay; 4, *European*, light-color, more spongy, produced by a different cynips; much tannin; 5, *American:* (*a*) *Q. alba*, light, spongy; little tannin; (*b*) *Q. virginiana* (*virens*), Texas—

resembles Aleppo but not tuberculated; tannin 40 p. c.; (*c*) *Q. lobata*, California, 5 Cm. (2′) broad, orange-brown, glossy, soft, spongy interior; much tannin.

CONSTITUENTS.—Tannin 50–60 p. c. (white galls 20–30 p. c.), Gallic acid 2–3 p. c., mucilage, sugar, fat, resin; in the nucleus starch.

Acidum Tannicum. Tannic Acid, $HC_{14}H_9O_9$, *U.S.P.*—(Syn., Acid. Tan., Gallo-tannic Acid, Tannin, Digallic Acid; Fr. Tannin officinal, Acide tannique; Ger. Gerbsäure.) Obtained by exhausting powdered nutgall with warm water, cooling, agitating the filtrate with one-fourth volume of ether; the emulsion separates in 10 days, yielding an upper ethereal layer (coloring matter, fat, resin, gallic and ellagic acids), which is discarded, and a lower aqueous fluid, containing tannin, which under reduced pressure, is concentrated in a still to syrupy consistence, cooled, and spread on thin glass plates to dry—these being placed on a steam table and covered over to produce puffy, spongy character. It is a yellowish-white, light brown amorphous powder, glistening scales, spongy masses, darker on exposure to air and light, odorless, faint characteristic odor; strongly astringent taste, acid reaction; soluble in water, acetone, alcohol, diluted alcohol, slightly in dehydrated alcohol, glycerin (1) heated, almost insoluble in ether, chloroform, benzene, petroleum benzin; owing to weak combination with variable proportions of glucose once considered a glucoside. *Tests:* 1. Aqueous solution + ferric chloride T. S.—bluish-black color or precipitate. 2. Aqueous solution precipitates nearly all alkaloids, glucosides, solutions of gelatin, albumin, starch (dist. from gallic acid). 3. On drying—loses 12 p. c.; incinerate—ash .5 p. c. *Impurities:* Gum, dextrin, resinous substances. *Incompatibles:* Alkalies, alkaloids, emulsions, gelatin, ferric salts, mineral acids, salts of antimony, lead and silver. Should be kept cool, dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Acidum Gallicum. Gallic Acid, $HC_7H_5O_5.H_2O$.—This organic acid is prepared usually from tannic acid by boiling 15 minutes 1 part (or 2 parts nutgall) with sulphuric acid (1) and water (5); strain while hot, set aside for crystallization; a once popular method consisted in exposing to the air a mixture of nutgall and distilled water in a thin paste for a month, adding water occasionally to keep semi-fluid, expressing, rejecting liquid, boiling residue with distilled water, filtering hot through animal charcoal, setting aside to crystallize. It is in white, pale fawn-colored, silky, interlaced needles or triclinic prisms; odorless; astringent, slightly acidulous taste; permanent, soluble in water (87), boiling water (3), alcohol (4.6), glycerin (10), ether (100), almost insoluble in chloroform; on drying loses 12 p. c.; saturated aqueous solution—acid; incinerate—ash .1 p. c. *Tests:* 1. Neutralize saturated aqueous solution with few drops of sodium hydroxide T. S.—gradually a deep green, changing to reddish by acids. 2. With ferrous solutions—neither colors nor precipitates; with ferric solutions—bluish-black precipitate. 3. Cold, saturated aqueous solution with

alkaloids, glucosides, albumin, gelatin T. S., starch T. S.—no precipitate (abs. of tannic acid). It is the hydride of tannic acid, the latter being the anhydride of gallic acid, a relationship and convertibility shown by the equations: (1) $2HC_7H_5O_5 - H_2O = HC_{14}H_9O_9$. (2) $HC_{14}H_9O_9 + H_2O = 2HC_7H_5O_5$. *Impurities:* Tannic acid, etc. *Incompatibles:* Ferric and other heavy metallic salts, spirit of ethyl nitrite. Dose, gr. 5–20 (.3–1.3 Gm.).

PREPARATIONS.—1. NUTGALL. 1. *Unguentum Gallæ.* Nutgall Ointment. (Syn., Ung. Gall., Ointment of Galls; Fr. Pommade de Noix de Galle; Ger. Gällapfelsalbe.)

Manufacture: 20 p. c. Rub nutgall 20 Gm. with ointment 80 Gm., gradually added, until thoroughly mixed, avoiding iron utensils; externally.

2. *Tinctura Gallæ, N.F.,* 20 p. c. (alcohol 9 + glycerin 1. Dose, ʒss–2 (2–8 cc.).

Unoff. Preps.: Fluidextract, ♏v–30 (.3–2 cc.). *Infusion,* 5 p. c., ʒj–2 (30–60 cc.). *Unguentum Gallæ cum Opio* (Br., nutgall 18 p. c., + opium 7.5 p. c.).

II. TANNIC ACID.—1. *Glyceritum Acidi Tannici.* Glycerite of Tannic Acid. (Syn., Glycer. Acid. Tan., Glycerite of Tannin; Fr. Glycéré de Tannin, Glycérine tannique; Ger. Tanninglycerit (glycerol.)

Manufacture: 20 p. c. Weigh glycerin 79 Gm. into tared, wide-mouthed bottle, suspend tannic acid 20, + sodium citrate 1, in gauze bag, in the glycerin; heat in water-bath until dissolved, stirring mixture occasionally. Dose, ♏x–30 (.6–2 cc.); externally.

2. *Trochisci Acidi Tannici.* Troches of Tannic Acid. (Syn., Troch. Acid. Tan.; Fr. Tablettes (Pastilles) de Tannin; Ger. Tanninpastillen.)

Manufacture: Rub together until thoroughly mixed tannic acid 6 Gm., sucrose 65, tragacanth 2, form mass with orange flower water q. s., divide into 100 troches. Dose, 1–3 troches.

3. *Unguentum Acidi Tannici.* Ointment of Tannic Acid. (Syn., Ung. Acid. Tan.; Fr. Pommade de Tannin; Ger. Tanninsalbe.)

Manufacture: 20 p. c. Dissolve tannic acid 20 Gm. in glycerin 20 Gm., with gentle heat, mix solution thoroughly with ointment 60 Gm., avoiding iron utensils.

4. *Collodium Stypticum, N.F.,* 16 p. c., + flexible collodion q. s. 100.

5. *Syrupus Iodotannicus, N.F.,* .54 p. c., + iodine .27 p. c.

Unoff. Prep.: Suppositoria Acidi Tannici (Br., each 3 gr. (.2 Gm.)).

III. GALLIC ACID.—1. *Pyrogallol. Pyrogallol,* $C_6H_3(OH)_3$, *U.S.P.* (Syn., Pyrogall., Pyrogallic Acid, Acidum Pyrogallicum; Fr. Acide pyrogallique; Ger. Pyrogallolum, Pyrogallussäure.) This trihydroxybenzene (triatomic phenol) is obtained by heating gallic acid for half an hour under pressure with water (3), boiling with animal charcoal, filtering, evaporating—$HC_7H_5O_5$ + heat = $C_6H_5(OH)_3 + CO_2$; yield 75 p. c. It is in light, white, nearly white leaflets, fine needles, odorless, bitter taste, acquiring grayish tint on exposure, soluble in water (1.7), alcohol

(1.3), ether (1.6), melts at 131° C. (268° F.). *Tests:* 1. Aqueous solution (1 in 10) reduces solutions of silver, gold and mercury salts, even in the cold; incinerate—ash .1 p. c. 2. Aqueous solution (1 in 20) neutral, slightly acid, colorless, yellowish, brown on exposure from absorbing oxygen; with a few drops of ferric chloride T. S.—brownish-red; with fresh ferrous sulphate T. S.—blue color. Should be kept dark, in well-closed containers.

PROPERTIES.—1. NUTGALL: Astringent, tonic; constringes muscular tissue, thus checking secretions, hemorrhages, local inflammations, etc.

II. TANNIC ACID: Local astringent. Internally—contracts blood-vessels, restrains peristalsis (constipates), coagulates mucous secretions, prevents secretion of gastric and intestinal juices, precipitates pepsin, etc.; it is converted into gallic acid in the intestines, and until this change is effected it cannot become absorbed to act as a remote or systemic astringent, simply being able to control locally gastric and intestinal bleeding. Externally—astringent, coagulates blood (forming a clot), albumin, and gelatin (tans tissues), is hemostatic, antiseptic, depressant, irritant; the salts have no astringency.

III. GALLIC ACID: Mild astringent, does not coagulate blood, hence recognized only as remote astringent, but not to raw and bleeding surfaces; internally—controls systemic hemorrhages (contracts blood-vessels), decreases secretion of urine and sweat; does not constipate like tannic acid, and is eliminated by the kidneys unchanged.

IV. PYROGALLOL: Violent irritant, depressing poison (large quantities); causes vomiting, purging, abdominal pain, quick pulse, low temperature, cyanosis (lips), convulsions, coma, death; urine dark (albumin, methemoglobin), blood chocolate colored, red corpuscles disorganized, liver changed as by phosphorus.

USES.—I. NUTGALL: Chronic diarrhea, dysentery, gleet, leucorrhea, antidote to tartar emetic and alkaloids (emetine, morphine, colchicine, strychnine, etc.), constringes the stomach, thus delaying absorption, forming of the alkaloids insoluble tannates. In cases of poisoning give infusion freely. Locally infusion as gargle for relaxed mucous membrane of mouth, throat, vagina, rectum: ointment with 5-10 p. c. opium, good in hemorrhoids after inflammatory stage. Chiefly used for obtaining tannic and gallic acids, for ink, dyeing, tanning.

II. TANNIC ACID: Hemorrhages (epistaxis, uterine, etc.), diarrhea, dyspepsia, cholera, relaxed uvula, coryza, inflamed fauces, diphtheria, toothache, aphtha, excessive salivation, leucorrhea, chapped nipples, gleet, gonorrhea, ulcers, piles, chilblains, chronic bronchitis, whooping-cough, phthisis, influenza, ozena, fissures, hemorrhoids, prolapsus ani and uteri, vesical catarrh, hemorrhage after extracting teeth, spongy gums (contracts vessels, checks absorption, hence loosening of teeth), obtunds sensitive dentine, either alone or combined with morphine and creosote, to toughen mucous membranes, skin around nipples, conjunctivitis, erectile tumors, ingrowing toe-nails; aqueous solutions (1 to 50)

may be injected into urethra and bladder, but should never be used hypodermically.

III. Gallic Acid: Menorrhagia, purpura, epistaxis, hemoptysis, hematemesis, hemorrhage of stomach, intestines, lungs, kidneys, night-sweats, polyuria, Bright's disease, dyspepsia, bronchitis, hemorrhoids, chronic ulcers, pyrosis, alopecia.

IV. Pyrogallol: Psoriasis, syphilitic ulcers, lupus, epithelioma, parasiticide for ringworm. Should not be applied over extensive surface, as absorption may poison; not used internally; ointment 1–5–10 p. c.

Allied Products:

1. *Chinese Nutgalls* (*Rhus semiala'ta*) by sting of *A'phis s(ch)inen'sis.*—Galls 4–5 Cm. ($1\frac{3}{5}$–2′) long, ovate, irregular, tuberculate, grayish-downy, hollow; shell thin, fragile, containing many insect-remains.

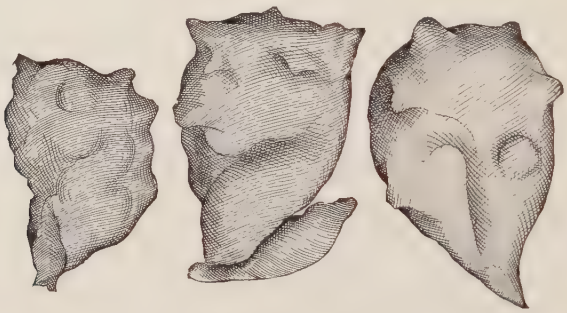


Fig. 85.—Chinese nutgalls.

2. *Japanese Nutgalls* (*R. semialata* or *R. japon'ica*) resemble Chinese.—The tannic acid of these differs from that of official galls.

3. *Vallonea, Acorn Cups* of many *Quercus* species (*Q. Robur, Q. Vallo'nea, Q. Æ'gilops*), 2.5 Cm. (1′) in diameter, with thick, spreading scales, strongly astringent taste, largely used in tanning.

4. *Tamarisk Galls* (*Tam'arix articula'ta* (*orienta'lis*), *T. africa'na. T. gal'lica*).—Asia, Africa, 3–12 Mm. ($\frac{1}{8}$–$\frac{1}{2}$′) thick, subglobular, knotty, contain tannin 40–50 p. c.

5. *American Nutgalls* (*Q. alba, Q. virginiana* (*virens*), *Q. lobata*), first poor in tannin: second (Texas) like Aleppo, but not tuberculate, tannin 40 p. c.; third (California), 5 Cm. (2′) thick, glossy, orange-brown, rich in tannin.

Allied Plants:

1. *Quer'cus al'ba, Quercus, White* (*Tanner's*) *Oak Bark, N.F.*—The dried inner bark of the trunk and branches with not more than 2 p. c. of outer bark or wood or other foreign organic matter; N. America. Stately tree 18–25 M. (60–80°) high, 1–2.5 M. (3–8°) thick, branched; leaves large, 4–6-lobed, petiolate, smooth, light green, glaucous with prominent veins beneath, brownish when dry; flowers monœcious—

staminate, catkins; pistillate, followed by 1-seeded ovoid fruit (nut, acorn), base in cupule. Bark, flat pieces, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, light brown, rough-fibrous, fracture uneven, coarsely fibrous; odor distinct; taste strongly astringent; does not tinge saliva yellow when

Fig. 86.—*Quercus alba: a*, staminate catkins; *b*, magnified staminate flower; *c*, pistillate flower with stigmas magnified; *d*, acorn in embryo; *e*, section of young acorn; *f*, cotyledon with radicle.

chewed; solvents: alcohol, water; contains tannin 6–11 p. c., oak-red, quercin, resin, fat, quercite. Astringent, tonic, hemostatic, similar to tannin; diarrhea, dysentery, cholera infantum, hemoptysis, hemorrhages, leucorrhea, gonorrhea, intermittents, phthisis, relaxed parts, ulcers; gargle — prolapsed uvula, etc.; poultice—gangrene, etc.; powder — tooth powders and washes; tanning leather; wood durable, valuable. Dose, gr. 15–60 (1–4 Gm.); decoction, 5 p. c., ℥ss–1 (15–30 cc.); extract, gr. 2–10 (.13–.6 Gm.); fluidextract (alcohol 50, water 40, glycerin 10), ♏xv–60 (1–4 cc.).

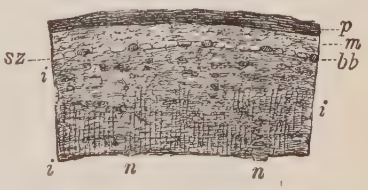


Fig. 87.—*Quercus alba:* bark, cross-section, magnified 10 diam.; *p*, cork; *m*, outer bark; *i*, inner bark; *sz*, group of stone cells; *bb*, bast-fiber; *n*, longitudinal fiber.

2. *Q. veluti'na* (*coccin'ea* var. *tincto'ria*), *Black* (*Scarlet*) *Oak* (*Quercitron*).—The (inner) bark, U.S.P. 1820–1870. Trees 24–30 M. (80–100°) high, 1–1.2 M. (3–4°) thick, leaves oblong, lobed, 15–20 Cm. (6–8′) long, mucronate; fruit, acorns, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) long, 12 Mm. ($\frac{1}{2}$′) thick, cupule thick, shallow; bark resembles the preced-

ing, only reddish-brown, gives saliva brownish-yellow color; contains tannin 6–12 p. c., quercitrin (red-brown coloring matter, dyeing yellow wool, silks, etc.), $C_{36}H_{38}O_{20}$, with diluted acids yields isodulcite, $C_6H_{14}O_6$, and yellow quercetin, $C_{24}H_{16}O_{11}$. In the South barks of *Q. nigra* and *Q. digitata* (*falcata*), used for this, although these have a much coarser texture and a deep reddish-brown color.

3. *Q. Ro'bur, Common European* or *English Oak.*—Tall tree, 24–30 M. (80–100°) high, having 3 forms: (*a*) *Q. pubes'cens* (old leaves hairy); (*b*) *Q. peduncula'ta* (leaves smooth, pistillate flowers, and fruit on peduncles; (*c*) *Q. sessiliflo'ra* (leaves smooth, flowers and fruit sessile, petioles long). These have many varieties, all resembling *Q. alba.*

4. *Q. digita'ta* (*falca'ta*, L. *falcatus*—*i. e.*, leaf-lobes scythe-shaped), *Spanish* or *Red Spanish Oak.*—Maryland-Florida. Tree 18–21 M. (60–70°) high, leaves grayish, 3-5-lobed, finger- or scythe-shaped. Bark rich in tannin, wood reddish, coarse-grained; used in tanning, sometimes called quercitron.

FIG. 88.—*Castanea dentata.*

FIG. 89.—Castanea: leaf, one-half natural size.

5. *Q. marylan'dica* (*ni'gra, ferrugin'ea*), *Black, Barren*, or *Iron Oak* (*Black Jack*).—Southern States. Tree 9–12 M. (30–40°) high, leaves cuneate, 3–5-lobed, rusty, pubescent beneath, shining above. Of little value.

6. *Q. virginia'na* (*vi'rens*, L. *virco*, green, fresh, flourishing), *Live Oak.*—Maryland-Florida. Tree 12–18 M. (40–60°) high. Bark rich in tannin, wood fine-grained; used in shipbuilding.

7. *Q. su'ber, Cork Oak, Alcornoque (Savanna Bark).*—Mediterranean Basin, S. United States. Small tree, 9–15 M. (30–50°) high, leaves toothed, ovate; bark with an elastic suberous layer 2.5–5 Cm. (1–2′) thick, collected every 8–10 years, and constitutes our cork of commerce. When finely powdered, sold as suberin for absorbent purposes, which name is applied to one of its constituents (fat). There are about 80 species of *Quercus*, ranging from shrubs to trees; one-half of these grow in the United States, and may, with their acorns, be used similarly. Acorns sometimes are roasted = *semen quercus tostum*, and used as a substitute for coffee; contain fixed oil, starch, citric acid, uncrystallized and quercite sugars.

8. *Casta'nea denta'ta, Castanea, Chestnut Leaves, N. F.*—The dried leaves with not more than 5 p. c. of stems or other foreign organic matter; N. America, W. Asia, S. Europe. Stately tree, 24–30 M. (80–100°) high; wood light, durable; flowers in 3's, monœcious—staminate and pistillate, involucre 4-lobed, becoming prickly; fruit, 4-valved involucre enclosing 1–3 1-seeded nuts. Leaves entire, slightly broken, folded or matted together, 15–25 Cm. (6–10′) long, 5 Cm. (2′) wide, oblong-lanceolate, acuminate, sharply serrate, coriaceous, dark green above, lighter beneath, pinnately veined, petiole stout; odor slight; taste astringent; Powder, greenish—non-glandular hairs, numerous calcium oxalate crystals in rosettes, prisms, parenchyma cells with brown tannin masses which + ammonio-ferric alum T. S.—blue; contains tannin 9 p. c., resin, fat, gum, albumin, ash 6 p. c.; fruit contains starch 35 p. c., fat 2 p. c., proteins 3–4 p. c., sugar 1–2 p. c.; solvents: boiling water, alcohol partially. Tonic, mild sedative, astringent; whooping cough, controlling paroxysms, dysentery; wood resists exposure greatly, nuts a delicacy, thoroughly edible. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Castaneæ* (100 Gm., + boiling water to exhaust, evap. to 200 cc., add alcohol 60 cc., lastly glycerin 10, dose, ℥xv–60 (1–4 cc.). *Infusion.*

9. *C. (Fagus) pu'mila, Castanea (Chinquapin).*—The bark, U. S. P. 1820–1850; Delaware-Mississippi. Shrub or small tree, 6–15 M. (20–50°) high, 25–27.5 Cm. (10–15′) thick, largest being South; leaves differ from chestnut in having underside white, downy; bark grayish, brownish inside; fruit rounded, conical, 12 Mm. ($\frac{1}{2}$′) long, 9 Mm. ($\frac{3}{8}$′) broad at base, same constituents and taste as chestnuts; bark contains tannin, resin, extractive. Tonic, astringent; intermittents.

10. *Fa'gus america'na (ferrugin'ea), American Beech.*—Tree, 22.5–30 M. (75–100°) high; bark and leaves used, the latter oblong-ovate, taper pointed, dentate, petioles and midrib soon (nearly) naked, prickles of fruit recurved or spreading; astringent, tonic.

15. ULMACEÆ. Elm Family.

Ul-ma'se-e. *Ulm-us* + aceæ, fr. Saxon *elm* or *ulm*—*i. e.*, its original name in all Celtic dialects. Trees, shrubs. Distinguished by leaves

ULMACEÆ

alternate, serrate, stipulate; sap not milky; flowers small, 3–9-parted or sepals; petals none, stamens 3–9; ovary 1-celled, superior; fruit 1-seeded, samara, drupe or nut; universal; demulcent, nutritive, astringent, tonic, timber.

Genus: **1. Ulmus.**

ULMUS. ELM, *U.S.P.*

Ulmus fulva, *Michaux.* } The dried inner bark.

Habitat. N. America, New England, S. Carolina, west to Louisiana, Nebraska.
Syn. Elm Bark, Slippery Elm, Moose-, Red-, Indian-, Sweet-, Rock or American Elm; British Tea (the leaves), Cortex Ulmi Interior; Fr. Écorce d'Orme (fauve); Ger. Ulmenrinde, Rüsterrinde.

Ul'mus. L. see etymology, page 163, of Ulmaceæ.

Ful'va. L. *fulvus,* deep yellow, tawny—*i. e.,* the color of the liber bark.

Plant.—Large tree, 15–18 M. (50–60°) high, .3–.6 M. (1–2°) thick; bark and wood reddish-brown, branches rough, whitish; leaves large 10–20 Cm. (4–8′) long, 5–7.5 Cm. (2–3′) broad, oblong, acuminate, unequal at subcordate base, unequally serrate, pubescent; rough on both sides, petiolate, buds covered with dense russet down; flowers April, small, appearing before leaves, sessile, in clusters, calyx downy, corolla wanting; fruit samara, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) long, flat, broadly oblong, entire, notched, 1-celled, wing yellow, silky with short fulvous hairs. Bark, usually broad, flat, oblong pieces, 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick; outer surface pale brown, roughened by longitudinal striæ and partially detached bundles of bast-fibers, occasionally patches of thin dark brown cork; inner surface light yellowish-brown, finely striate; fracture fibrous, projections of fine bast bundles; odor distinctive; taste mucilaginous. Powder, light brown (fawn)—numerous bast-fibers, calcium oxalate prisms, starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{16625}$′) broad, numerous mucilage fragments, cork cells few or absent. *Test:* 1. Macerate for 1 hour 1 Gm. in water 40 cc.—light brown mixture of thick mucilaginous consistence. Dose, ʒij–4 (8–15 Gm.).

Adulterations.—Bark: Barks that are more brittle, less fibrous and mucilaginous; Powder: Corn meal, flour, starches.

Commercial: Tree flourishes in open high places, firm dry soil, being distinguished from *U. americana* by character of branches (rougher), leaves, buds, flowers, seed. Bark should be collected in spring, deprived of epidermis, and dried, for which trees are felled in Michigan and other Western States, peeled and wood burnt or allowed to decay.

Constituents.—Mucilage, starch and tannin (slight), ash 8–10 p. c.; European bark also contains tannin (considerable) and bitter principle, but no starch.

Mucilage.—Resembles that of flaxseed—precipitated by lead acetate, but alcohol separates from its solution a gelatinous liquid.

PREPARATIONS.—1. *Trochisci Ulmi, N. F.*, gr. 3 (.18 Gm.). *Mucilage*, 6 p. c. (if to be free from starch must use cold water); dose, *ad libitum*. *Poultice*. *Uterine tents*.

PROPERTIES.—Demulcent, emollient, nutritive.

USES.—Dysentery, diarrhea, diseases of urinary passages, bronchitis. Externally—finely ground or powdered bark mixed with hot water into pasty mass and used as a poultice for inflammations, boils, etc.; in shape of tents to dilate fistulæ, strictures, os uteri, also in form of vaginal and rectal suppositories.

Allied Plants:

1. *Ulmus campes'tris.*—Europe. Bark thinner than official, cinnamon color, mucilaginous, bitterish, astringent. *U. effu'sa*, *Black Elm*, bark very similar; *U. america'na*, *White Elm*, New England, chiefly shade tree; *U. ala'ta*, *Wahoo*, S. United States. Bark used in making ropes.

16. MORACEÆ. Mulberry Family.

Mo-ra'se-e. L. *Mor-us* + aceæ, fr. Celtic *mor*, black—*i. e.*, alluding to the fruit's color. Trees, shrubs, herbs. Distinguished by leaves alternate or opposite, stipulate; sap milky; flowers monœcious or diœcious; calyx 4–5-parted, petals none, staminate panicled, pistillate capitate, cymose; ovary superior, 1-celled, ovule solitary; fruit various; universal; narcotic, sedative, tonic, astringent, fibers.

Genus: **1. Cannabis.**

CANNABIS. CANNABIS, *U.S.P.*

Cannabis sativa, *Linné.*

The dried flowering tops of pistillate plants with not more than 10 p. c. fruits, large foliage leaves, stems over 3 Mm. ($\frac{1}{8}'$) thick, nor 2 p. c. other foreign organic matter, yielding not more than 5 p. c. acid-insoluble ash.

Habitat. Asia, Persia, hills of N. India; cultivated in India, Europe, C. and S. Russia, Brazil, W. and S. United States.

Syn. Cannab., Cannabis Indica, U. S. P. 1900, Guaza, Ganjah, Indian Hemp, Black Indian Hemp, Tristram's Knot, Bangue, Hashish, Halish, Gallow Grass Hemp, Neck or Nick Weed, St. Andrew's-lace, Welsh Parsley, Bang, Bhang, Gunjah Churrus, Charas, Ganja (dried flowers); Fr. Chanvre (Indien); Ger. Hanf, Indischer Hanf.

Can'na-bis. L. Gr. κάνναβις, hemp, fr. *ganch*, its Arabic name. Celtic *can*, reed + *ab*, small—*i. e.*, its slender stems.

Sa-ti'va. L. *sativus*, that which is sown or planted—*i. e.*, in the gardens and fields for use.

In'di-ca. L. *Indicus*. Gr. Ἰνδικός, pertaining to India—*i. e.*, its habitat.

PLANT.—Annual herb; stem 1–3 M. (3–10°) high, angular, tomentose; leaves palmate-compound; leaflets 5–7 linear-lanceolate, serrate; flowers diœcious, yellow spikes. FLOWERING TOPS, separate, or in

more or less agglutinated masses, fragments consisting of short stems with leaf-like bracts, pistillate flowers or somewhat developed fruits, greenish-brown; odor agreeable, heavy, narcotic; taste acrid, pungent. POWDER, dark green—leaf epidermis with oval stomata beneath, numerous non-glandular hairs usually with calcium carbonate masses, glandular hairs 2 kinds, yellowish-brown laticiferous vessels, calcium oxalate rosette aggregates, tracheæ and phlœm, embryo and endosperm tissues with numerous oil globules, aleurone grains (crystalloids, globoids); on slide—effervesces with diluted hydrochloric acid; alcoholic solution bright green; alcoholic extractive 8 p. c. Should not be kept longer than 1 year, when it usually is only one-fourth as strong as the fresh, and in 2 years it practically is inert. *Solvent:* alcohol. Dose, gr. 1–5 (.06–.3 Gm.).

Commercial.—Plant was known to the Romans, but not to the Egyptians, and has been cultivated universally many centuries for fiber, seed, and medicine—that for the latter at present being grown mostly in the two districts, Bogra and Rajshabi, north of Calcutta, in rows, the richest in resin at 1,800–2,400 M. (6,000–8,000°) elevation. When mature (indicated by brown color and falling of leaves) the flowering branches are cut off, May–June, cured by wilting, pressing, rolling, and shaking out of leaves and fruits (if any of the latter have developed), and as such is recognized natively by the Hindustani names, *ganja, gunjah;* the rolling and treading are performed by human feet, an art demanding training, the object being possibly to work resinous matter from stems into inflorescence tips. There are two kinds: 1, *Round ganja*, requiring 4 days for kneading each branch into a cylindrical or terete mass; 2, *Flat ganja*, requiring 2 days for working into a flat form; the Bengal (Calcutta) ganja (best) is brownish or dusty, the Bombay bright green. Variability in the drug may be due to the presence of staminate flowers, leaves, fruits, cold weather, inopportune collecting (not later than 4 days after maturing), intentional removal of resin, excessive age (losing most of its properties within a year). Great care is taken to prevent the flowering tops becoming fertilized by suppressing the male plants, as a single one is claimed to spoil an entire field; however, when for fiber or seed both male and female plants are cultivated together. Our plant, often called *Cannabis americana*, having escaped from native country, may possess slight variations owing to colder climate, but under proper cultivation and care may be as active as the India product, in spite of which it is regarded generally as being about one-fourth weaker.

FIG. 90.—*Cannabis sativa.*

CONSTITUENTS.—Cannabinol, Cannabin 15–20 p. c., choline (bilineurine—trimethylamine), volatile oil (chiefly sesquiterpene—cannabene), $C_{10}H_{16}$, .3 p. c., bitter principle, paraffin, $C_{29}H_{60}$, chlorophyll, gum, sugar, potassium nitrate, ash 5–15 p. c.

Cannabinol, $C_{21}H_{26}O_2$.—This, to which the activity of the drug is due, may be obtained by exhausting cannabis with petroleum benzin, reclaiming latter, evaporating residue to dryness, and subjecting it, under pressure to fractional distillation at 210–240° C. (410–464° F.), when the distillate contains cannabinol and paraffin, the latter being removed with alcohol. It is a poisonous, yellow or brownish syrupy liquid, darkening on exposure to air into inert, brittle, pitchy mass, consequently must be kept, as well as preparations of the drug, in sealed containers; possibly same as Kobert's cannabindon.

Cannabin.—Resin constituent (resinoid), to which formerly was attributed all of the drug's activity, that now known to be due solely to its contained cannabinol; it may be obtained by treating cannabis with water and a solution of sodium carbonate, washing residue with water, drying, exhausting with alcohol, treating tincture with milk of lime, precipitating lime with sulphuric acid, adding animal charcoal to filtrate, filtering, concentrating, and precipitating with water; it is a brown, amorphous resin, burning without ash, soluble in alcohol, ether, from the former being precipitated white by water.

PREPARATIONS.—1. *Extractum Cannabis.* Extract of Cannabis. (Syn., Ext. Cannab., Extract of (Indian) Cannabis (Hemp); Fr. Extrait de Chanvre (Indien); Ger. (Indisch) Hanfextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.), stirring frequently, to pilular consistence, mix thoroughly; after assay add enough storax or substandard extract of cannabis for biological standard; yield 12–14 p. c. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.): Prep.: 1. *Mistura Chloralis et Potassii Bromidi Composita, N.F.*, $\frac{1}{5}$ p. c.

2. *Fluidextractum Cannabis.* Fluidextract of Cannabis. (Syn., Fldext. Cannab., Fluid Extract of Cannabis; Fr. Extrait fluide de Chanvre (Indien); Ger. (Indisch) Hanffluidextrakt.)

Manufacture: Similar to Fluidextractum Colchici, page 111; menstruum: alcohol; after dissolving soft extract in the reserve, assay and adjust finished volume to its biological standard—amount producing incoördination in a dog; .1 cc. for every 2 pounds (1 Kg.) of body weight. Dose, ♏ij–5 (.13–.3 cc.): Preps.: 1. *Collodium Salicylicum Compositum, N.F.*, 10 p. c. 2. *Mistura Chloroformi et Morphinæ Composita, N.F.*, 1.85 p. c.

Unoff. Prep.: Tincture, 10 p. c. (alcohol), ♏v–30 (.3–2 cc.).

These preparations give varying results, but usually their value can be recognized by the color of the precipitate formed when added to water; if olive-green, it is active; if yellowish-brown, it is inert; thus, whatever there is that destroys chlorophyll injures the active principle.

PROPERTIES.—Anodyne, nervine, sudorific, narcotic, aphrodisiac, increases appetite. It excels even belladonna in perverting perception, condition, and relation of objects; some subjects become pugnacious, others have delightful intoxicating dreams, in which time, distance, and sound are magnified—a few minutes' dream extends over weeks, near objects as in infinite space, whispering as cannonading. Large habitual doses bloat the face, inject eyes, make limbs tremulous, weak, mind imbecilic, death by marasmus.

USES.—Neuralgia, distressing cough, quiets tickling in throat, does not constipate or depress like opium; gout, delirium tremens, tetanus convulsions, chorea, hysteria, mental depression, epilepsy, morphine and chloral habits, softening of the brain, nervous vomiting.

Poisoning: Have pleasurable intoxication, double consciousness followed by drowsiness, unconsciousness, collapse, insensibility, dilated pupils, rapid pulse, slow respiration, debility, pale, clammy, insensitive skin, catalepsis, excited passion; effects usually last 24 hours, and closely resemble those of opium, differing, however, in not constipating and in not lessening secretions; increases appetite. Give emetics, lemon juice to neutralize its effects, tannin, coffee, ammonia, strychnine, atropine, electricity, spirit of nitrous ether, artificial respiration; similar to chloral hydrate and opium.

Incompatibles: Strychnine, caustic alkalies, acids.

Synergists: Alcohol, ether, bromides, cocaine, narcotics.

Allied Native Products:

These are mostly used for smoking, beverages, or electuaries, etc.

1. *Bhang* (*Sidhee, Subjee, Siddhi*).—Consists of the dried coarsely broken leaves and fruit (dark green), resembles *ganja* in odor and taste; used by natives in their sweet-meat (*majoon*), also smoked with or without tobacco; its cold infusion (tea) as an intoxicant.

2. *Churrus, Churras, Charas.*—This is the resin (practically the active constituent) which exudes spontaneously from the entire plant in minute drops. It is collected in several different ways: 1. By men, wearing leather suits, brushing forcibly against growing plants, whereby resin adheres and afterward is scraped off. 2. By rubbing green portions between the hands and then scraping off adhering resin. 3. By frequent stirring around that put away in barns to cure, thus causing the resin to rise in the form of dust, and to deposit upon the roof and sides of the building, from which it can afterward be collected. Owing to this being more or less impure it is not used in medicine, but solely smoked in pipes; contains usually cannabinol 33 p. c.

3. *Hashish* (*Hasish, Haschisch, Hasash, Hasheesh—Majoon.*—The Arabic name for hemp, signifying "green intoxicating liquor" fr. Heb. *shesh*, to be joyous. This may consist of the dried tops collected before seed ripen, thereby resembling *ganja, gunjah*, but usually is more complex, being prepared by heating tender leaves and tops 4 parts, butter 3, water 4, until latter is dissipated, straining, washing twice the greenish extract with water, adding this to syrup (sugar 16, water 32, little

milk, boil), heating, mystifying by incorporating stramonium or nux vomica; in Bengal a small amount of rose oil, musk, cardamom seed, cantharides, or opium (to which mostly is due the deliriums, manias, dreams, sensualism), boiling half an hour, allowing to solidify, cutting into cakes; the Russians prefer it formed into cakes with the resinous extract.

4. *Hemp Seed* (*Cannabis Semen*).—These are achenes 3 Mm. ($\frac{1}{8}'$) long, roundish, smooth, greenish, taste sweet, oily. Used for birds chiefly, but, owing to the fixed oil, an emulsion becomes a valuable demulcent and anodyne; contain protein 22–24 p. c., fixed oil 28–36 p. c., suitable for painting, varnishing, etc.

5. *Hemp Oil.*—A greenish fixed oil, lighter and brownish on exposure; odor hemp-like, taste mild. Demulcent, protective; chiefly extracted for its possible use in the domestic arts; neither this nor seed possess narcotic properties.

6. *Hemp Fiber.*—Used for cordage, sacking, sail cloths, clothing, etc. The colder climates produce the best fibers, and the tropics that which is most medicinal and intoxicating. Russia produces most of the hemp fiber, but Italy the best; that grown in the United States and India is inferior to that of the other two countries.

Allied Plants:

1. *Hu'mulus Lu'pulus, Humulus, Hop, N.F.*—The carefully dried strobile bearing its glandular trichomes with not more than 2 p. c. of stems, leaves, or other foreign matter, yielding not more than 5 p. c. of acid-insoluble ash; N. Temperate Zone—N. America, C. Asia, cultivated. Perennial herbaceous twiner (left to right), stems several, 6 M. (20°) long, flexible, flowers diœcious, pistillate greenish, cone-like spikes producing the fruit. Strobile (fruit) ovoid-cylindical, 3 Cm. ($1\frac{1}{5}'$) long, flexuous rachis, numerous yellowish-green membranous scales, the base of each with numerous brownish glandular hairs (lupulin) and enclosing a glandular achene; odor strong, characteristic —disagreeable, valerian-like on aging; taste aromatic, bitter; should be kept dark, in tightly closed containers. Powder, yellowish-green —parenchyma cells with calcium oxalate rosettes, branching tracheæ, non-lignified hairs, glandular hairs with yellowish oil, few pollen grains, large cells with calcium carbonate cystoliths; solvents: diluted alcohol, boiling water; contains volatile oil .8 p. c., choline (lupuline), resin (3) 9–18 p. c., trimethylamine, tannin (lupulo-) humulo-tannic acid, sugar, salts. Tonic, stimulant, nervous, sedative, anodyne, hypnotic; nervous insomnia, dyspepsia, delirium tremens, hysteria, irritable bladder, rheumatism, abscesses (poultice). Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Humuli* (alcohol 5 vols., water 3), dose, ♏xv–60 (1–4 cc.); 2. *Tinctura Humuli*, 20 p. c. (diluted alcohol), dose, ʒj–2 (4–8 cc.). *Infusion*, 5 p. c.; extract, elixir, poultice.

Lupulinum, Lupulin, N.F.—The glandular trichomes separated from the strobiles, yielding not less than 60 p. c. of ether-soluble extractive nor more than 10 p. c. of acid-insoluble ash. It is a yellowish-

brown, granular powder, characteristic odor and taste of hop, being obtained therefrom by removing scales, shaking, and rubbing glands through fine sieve—yield 8–16 p. c.; trichomes globular, ellipsoidal,

FIG. 91.—*Humulus Lupulus: a*, staminate flower; *b*, pistillate flower; *c*, sepal; *d*, bract; *e*, embryo; *f*, lupulinic gland (lupulin).

.1–.3 Mm. ($\frac{1}{250}$–$\frac{1}{80}$′) broad, layer of secreting cells in form of shallow cup, the cuticle on inner surface being separated by secreted yellowish oleoresin; should be kept dark in tightly closed containers and when dark reddish and of disagreeable valerian-like odor from aging must not be used. Dose, gr. 5–15 (.3–1 Gm.); 1. *Fluidextractum Lupulini* (alcohol), dose, ♏v–30 (.3–2 cc.). *Oleoresin* (acetone, ether) gr. 5–15 (.3–1 Gm.); *Tincture*, 12 p. c. (alcohol); Pills (excipient—little ether, or heat, or brisk rubbing with spatula.

FIG. 92.—Lupulin (fresh).

2. *Fi'cus Car'ica, Ficus, Fig, N.F.*—The clean, sound, partially dried fruit; W. Asia, cult. in S. Europe, California. Tree, 4.5–7.5 M. (15–25°) high, 10–20 Cm. (4–8′) thick, many spreading branches; bark reddish, gray; leaves 10–12.5 Cm. (4–5′) long, 3–5-palmately bluntly lobed, dentate, pubescent beneath; flowers monœcious, borne on the

inside of the thick, fleshy-walled receptacle, which becomes the fruit. Fruit, irregular rounded shape, compressed, fleshy 2.5–5 Cm. (1–2′) broad, brownish-yellow, frequently with an efflorescence of sugar, apex with small scaly orifice, base with scar or short stalk; internally

FIG. 93.—*Ficus Carica: a*, vertical section of fruit; *b*, staminate flower; *c*, pistillate flower.

hollow, with many small brownish-yellow, glossy, hard achenes; odor distinct, fruity; taste sweet, pleasant; pear-shape when softened in water 5–7.5 Cm. (2–3′) long. They occur as *natural* and *pulled*, the largest and best being—Smyrna (Turkey, Elemi), the smaller and less

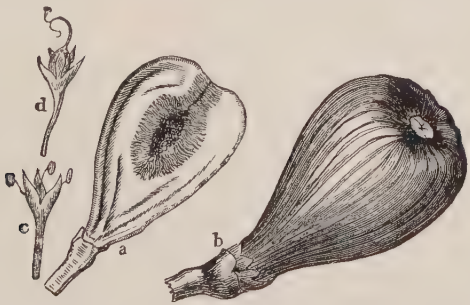


FIG. 94.—*Ficus Carica: a*, vertical section of common receptacle; *b*, ripened fruit; *c*, staminate flower; *d*, pistillate flower.

pulpy—the Greek; contain grape-sugar 62 p. c., gum, fat, phosphates, chlorides, achenes and cellular tissue 15 p. c., water 16 p. c. Nutritive, demulcent, dietetic; habitual constipation—fresh juice, indigestible skin and seed causing intestinal irritation, the latter acting mechan-

ically; roasted and split open as a poultice. Dose, *ad libitum;* 1. *Syrupus Ficus Compositus,* 30 p. c., + fldext. senna 20, arom. fldglycer. casc. sagr. 10, dose, ℥j–2 (4–8 cc.); 2. *Confectio Sennæ,* 7 p. c.

3. *Dorste'nia Contrayer'va, Contrayerva.*—The root, U. S. P. 1820–1850; W. Indies, C. and S. America. Acaulescent perennial; leaves lobed, radical, 10 Cm. (4′) long; flowers staminate and pistillate, fruit capsule, disperses seed by hygroscopism; root (rhizome) fusiform, 1–2-headed, 5-7.5 Cm. (2–3′) long, 12 Mm. (½′) thick, reddish; odor unpleasant; taste acrid, bitter; contains contrayerbine, cajapine, volatile oil, resin, bitter principle, starch. Stimulant, tonic, aromatic, stomachic; low fevers, typhoid, diarrhea, dysentery, serpent bites; in decoction, tincture. Dose, gr. 30 (2 Gm.).

4. *Mo'rus ru'bra, Red Mulberry.*—N. America. Fruit in dense spikes with coalesced perianths, 2.5 Cm. (1′) long, dark purple, fleshy; contains sugar 10 p. c., pectin, citrates, malates; refrigerant, flavoring.

5. *Urti'ca dioi'ca, Nettle (Stinging Nettle).*—Urticaceæ; N. America, Europe. Plant .6–1 M. (2–3°) high, very bristly, stinging, leaves ovate, heart-shaped, pointed, serrate, downy beneath, upper stem downy, spike much branched. Tonic, astringent, uterine hemorrhage. Dose, gr. 15–30 (1–2 Gm.).

17. SANTALACEÆ. Sandalwood Family.

San-ta-la'se-e. L. *Santal-um* + aceæ. Pers. name *sandul*, useful, or fr. L. *sandal*, Gr. σάνταλον, the classic name for Skt. *chandana*—*chand*, shine; L. *candere*, to shine—*i. e.*, polished woody surface shines. Herbs, shrubs, trees. Distinguished by leaves entire, exstipulate; calyx 3–6-lobed, coherent with 1-celled ovary, superior, valvate; flowers perfect, greenish, petals none, stamens 3–9, ovules 1–4, suspended; fruit 1-seeded, drupe or nut; temperate climates, tropics; astringent, seeds oily, fruit edible.

Genus: **1. Santalum.**

SANTALUM ALBUM. SANDALWOOD, *N.F.*

Oleum Santali. Oil of Santal, *U.S.P.*

Santalum album, *Linné.* — A volatile oil distilled from the dried heart-wood, yielding not less than 90 p. c. of alcohols, calculated as santalol.

Habitat. S. India, E. Indian Islands, Malabar, Macassar (mountains); cultivated.

Syn. White Sandal Wood (young wood), White Saunders, Saunders, Yellow Sandal (old wood), Almug; Ol. Santal., Santalwood Oil, Oil of Sandalwood, Oleum Ligni Santali, Oleum Santali Flavi; Fr. Santal Citrin; Essence de Santal, Oleum Santali æthereum; Ger. Gelber Sandel; Sandelöl, Santelöl, Ostendisches Sandelholzöl.

San'ta-lum. L. see etymology, above, of Santalaceæ.

Al'bum. L. *albus*, white or light—*i. e.*, the color of the sapwood.

PLANT.—Small tree 6–9 M. (20–30°) high, bark grayish-brown; leaves oval, smooth, glaucous beneath; flowers small, numerous cymes; odorless, color variable, violet-pink, red, yellow. Wood—Santalum Album, Sandalwood, *N. F.* The heart-wood with not more than 1 p. c. of foreign organic matter, yielding not less than 3.5 p. c. of volatile oil. It is in billets, pieces, chips, varying shapes and sizes, heavy, hard, splitting easily, yellow inside (heart-wood), whitish (sapwood); odor characteristic, aromatic, persistent; taste peculiar, aromatic. The heart-wood only should be used, which natively is obtained by

FIG. 95.—*Santalum album:* flowering branch; also flower and fruit, enlarged.

felling trees of .3 M. (12′) diameter, hacking off sapwood, or allowing these trunks to remain on the ground until sapwood is eaten away by ants, thereby becoming 10–20 Cm. (4–8′) thick. This, when rubbed, rasped, or heated, gives pleasant roseate odor.

CONSTITUENTS.—Volatile oil 2–5 p. c., resin, tannin.

Oleum Santali. Oil of Santal.—This volatile oil, distilled from the wood, is a pale yellow, somewhat viscid, oily liquid, characteristic odor and taste of sandalwood, soluble in 70 p. c. alcohol (5), solution being slightly acid, sp. gr. 0.972, levorotatory; contains alcohols, calculated as santalol (most important constituent), $C_{15}H_{26}O$, 90 p. c., and santalal,

$C_{15}H_{24}O$, both being decomposed by distillation over P_2O_5—santalol yielding santalene, $C_{15}H_{24}$, and santalal giving $C_{15}H_{22}$; also present sesquiterpene, possibly acids. *Tests:* 1. Australian oil, sp. gr. 0.953, and W. Indian oil, sp. gr. 0.965, are both dextrorotatory. 2. Should be clear in 10 vols. of 70 p. c. alcohol (abs. of cedar-wood oil, castor oil, other fatty oils). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–20 (.3–1.3 cc.).

Adulterations.—Castor oil, other fixed oils, chloroform, gurjun balsam oil, volatile oil of copaiba and of cedar-wood, made from lead-pencil chips by distillation, etc. While that distilled in India and Germany is a good article, that made in England is considered the best and purest, hence is more expensive.

Preparations.—I. Wood: 1. *Fluidextractum Santali Albi, N.F.* (alcohol), dose, ʒss–2 (2–8 cc.): Prep.: 1. *Elixir Sabal et Santali Compositum, N.F.,* 6.5 p. c. 2. *Tinctura Sabal et Santali, N F.,* 6.5 p. c.; II. Oil (Unoff.): *Capsules, Emulsion, Mass, Pills, Wafers.*

Properties.—Astringent, stimulant, diuretic, disinfectant, expectorant. Excreted by bronchial and genito-urinary mucous membranes, stimulating and disinfecting secretions of both.

Uses.—Bronchitis, gonorrhea, chronic and subacute inflammations of mucous membranes, cystitis, pyelitis, chronic diarrhea. Very much like copaiba and cubeb in action, and should be continued some time after discharges have ceased. Extensively employed in perfumery. The wood is used natively for fevers, indigestion, palpitation, inflammations, skin diseases; also as incense in Chinese temples, and by cabinet-makers for caskets, jewel boxes, and as a perfume. There are three varieties: 1, Malabar; 2, Macassar; 3, W. Indian.

Allied Plants:

1. *Santalum Freycinetia'num* and *S. pyrula'rium* of the Sandwich Islands. *S. Ya'si* of the Feejee Islands. *S. austro-caledon'icum* of New Caledonia. All 3 furnish oil of good quality.

2. *Venezuela Sandal Wood.*—Rutaceæ. This supplies the market with W. Indian sandalwood oil.

18. ARISTOLOCHIACEÆ. Birthwort Family.

Ar-is-to-lo-ki-a'se-e. L. *Aristolochi-a* + aceæ, fr. Gr. ἄριστος, best, + λοχεία, childbirth—*i. e.*, once thought to ease labor. Low herbs, climbing shrubs. Distinguished by abounding in bitter principles and volatile oils; flowers perfect, dull color; calyx conspicuous, lurid, tubular, coherent with 6-celled ovary, forming a many-seeded, 6-celled capsule or berry fruit; petals none; stamens 6–12, epigynous; leaves cordate, entire, petioled; temperate climates; tonic, stimulant, acrid, cures snake bites.

Genus: **1. Aristolochia.**

SERPENTARIA. SERPENTARIA, *U.S.P.*

Aristolochia { **Serpentaria,** *Linné,* **reticulata,** *Nuttall.* } The dried rhizome and roots, with not more than 10 p. c. over-ground stems nor 2 p. c. other foreign organic matter, yielding not more than 10 p. c. acid-insoluble ash.

Habitat. United States, in hilly woods: 1. W. Pennsylvania, Virginia, Ohio, Indiana, Kentucky. 2. S. W. States, Louisiana to Texas.

Syn. Serpent., Virginia Snakeroot, Texas Snakeroot, Snakeroot (-weed), Serpentary, Sangrel, Snagrel, Sangree Root, Pelican Flower, Birthwort, Thick Birthwort; Br. Serpentariæ Rhizoma (radix), Serpentary Rhizome; Fr. Couleuvrée de Virginie, Serpentaire (Vipérine) de Virginie; Ger. Virginische Schlangenwurzel.

Ar-is-to-lo'chi-a. L. see etymology, page 174, of Aristolochiaceæ.

Ser-pen-ta'ri-a. L. *serpen(t)s,* serpent—*i. e.,* having power of rendering harmless serpent bites.

Re-tic-u-la'ta. L. *reticulatus,* fr. *rete,* a net—*i. e.,* leaves strongly netted.

Virginia Snakeroot. Root from Virginia, once thought a valuable antidote for snake bites.

PLANTS.—Perennial herbs; stems sometimes several, slender, erect, zigzag, jointed .3 M. (1°) high, purple below; leaves cordate, ovate, 5–7.5 Cm. (2–3′) long, pale green, entire; flowers June–July, few, purple, due to the calyx, which is tubular, inflated at both ends and bent like letter S; corolla absent; leaves (*A. Serpentaria*)—petiolate, pointed, thin, pubescent; leaves (*A. reticulata*)—subsessile, obtuse, thickish, reticulate, hairy. RHIZOME, oblique, subcylindical, more or less curved, 10–30 Mm. ($\frac{2}{5}$–$1\frac{1}{5}$′) long, 1–2 Mm. ($\frac{1}{25}$—$\frac{1}{12}$′) thick, dark brown, upper portion with short stem-bases, lower and lateral portions with many long, thin, nearly straight, yellowish-brown roots having 4–6-rayed stele (stem 6–10 fibro-vascular bundles); fracture short; internally yellowish-white, wood with broad, eccentric wedges; odor camphoraceous, terebinthinate; taste bitter, aromatic. POWDER, grayish-brown—numerous starch grains, .003–.018 Mm. ($\frac{1}{8300}$—$\frac{1}{1385}$′) broad, tracheæ, wood-fibers, medullary ray cells, pith cells, occasionally few non-glandular hairs of the stem. *Solvents:* alcohol; diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Rhizomes of: 1, *Spigelia marylandica*—only slightly aromatic and bitter, no projecting stem-remnants, but indistinct, medullary rays in the wood; 2, *Hydrastis canadensis*—yellow interior, odorless, oblique growth; 3, *Aristolochia Serpentaria* var. *hasta'ta,* S. Carolina, La.—Leaves auriculate, stems smaller, more simple and slender; 4, *Cypripedium hirsutum* (*pubescens*) and *C. parviflorum*—scars circular, roots coarse; 5, *Polemo'nium rep'tans*—resemble serpentaria, but nearly white; 6, Roots of *Panax quinquefolium, Ginseng.*

Commercial.—Plants grow in rich shady woods from which the rhizomes are taken and dried, sometimes having been washed; enters market in bags, casks, more commonly bales of 100 pounds (45 Kg.),

often mixed with leaves, stems and adhering earth. There are two varieties: 1, *Virginia Snakeroot* (*A. Serpentaria*), exterminated practically from many former sections, and now largely from mountainous districts, south of Pennsylvania and the Ohio River, being brought eastward chiefly by the routes of Wheeling and Pittsburgh; 2, *Texas Snakeroot* (*Red River—A. reticulata*), rhizome usually larger, roots fewer, thicker, less interlaced than preceding.

Fig. 96.—*Aristolochia Serpentaria.*

Constituents.—Volatile oil .5–1 p. c., Aristolochine, Aristolochin (clematitin, bitter principle), Serpentarin (bitter principle, poisonous), resin 5 p. c., aristinic acid (resinous), tannin, starch, sugar, mucilage, albumin, ash 11 p. c.

Volatile Oil. — Obtained by distilling with water; contains a terpene (probably pinene), $C_{10}H_{16}$, also borneol ester, $C_{18}H_{29}O$, 60 p. c., and a green or bluish-green fraction.

Aristolochine, $C_{32}H_{22}O_{13}N$. — Obtained by precipitating decoction with lead acetate, exhausting precipitate with hot alcohol, evaporating, dissolving bitter principle (alkaloid) by shaking with water; it is yellow, amorphous or in needles; soluble in water, alcohol, ether, precipitated by tannin.

Preparations.—1. *Tinctura Cinchonæ Composita,* 2 p. c. 2. *Fluidextractum Serpentariæ, N.F.* (80 p. c. alcohol). Dose, ♏v–30 (.3–2 cc.); 3. *Tinctura Serpentariæ, N.F.*, 20 p. c. (67 p. c. alcohol). Dose, ʒss–2 (2–8 cc.).

Unoff. Prep.: Infusion, 5 p. c., dose, ʒj–2 (30–60 cc.).

Properties.—Stimulant, tonic, diaphoretic, diuretic, emmenagogue, aphrodisiac, antiperiodic; like calumba promotes appetite, digestion, increases bronchial and intestinal secretions, heart action, mental exhilaration. Large doses are irritant, causing vomiting, vertigo, colic, purging, tenesmus.

Uses.—As a stimulating expectorant in typhoid pneumonia, exanthematous diseases, intermittents, dyspepsia, diphtheria. Fluidextract good locally against poison-ivy rash.

Allied Plant:

1. *As'arum canaden'se, Asarum, Canada Snake-root, Wild Ginger, N.F.* The dried rhizome and roots with not more than 5 p. c. of foreign organic matter, North America. Small plant with dividing stem;

leaves 2, reniform; flowers brownish-purple, woolly; fruit capsule, 6-celled. Rhizome 5–17 Cm. (2–7′) long, 2–4 Mm. ($\frac{1}{12}$–$\frac{1}{6}$′) thick, 2-edged (young), quadrangular (old), finely striate, nodes with irregular scars, internodes with annular scars, purplish-brown, fracture short, whitish, few starchy or resinous roots; odor ginger-like or recalling serpentaria, non-irritating upon heating; taste pungent, bitter. Powder, brownish—starch grains, tracheæ, epidermal tissue, parenchyma and numerous oil cells; contains volatile oil 1.5–3.5 p. c., resin, asarin. Stimulant, carminative, tonic, diaphoretic, diuretic; whooping cough, colic, febrile affections. Dose, gr. 30 (2 Gm.); 1. *Syrupus Asari Compositus*, 6.2 p. c., + fldext. ipecac $\frac{3}{10}$ p. c., potassium carbonate $\frac{1}{4}$ p. c., +, dose, ʒss–1 (2–4 cc.). *Infusion*. *Tincture*.

Fig. 97.—Serpentaria: rhizome with roots.

Rhizome: transverse section.

19. POLYGONACEÆ. Buckwheat Family.

Pol-i-go-na′se-e. L. *Poligon-um* + aceæ, fr. Gr. πολύς, many, + γόνη, knee, joint—*i. e.*, from stem's numerous joints. Herbs, shrubs. Distinguished by acrid, astringent, purgative properties, stems composed of many swollen joints, with ocreate stipules above each; flowers perfect, on jointed pedicels; calyx 3–6, greenish or petaloid, inferior; ovary 1-celled, superior, styles and stigmas 2–3; stamens 6–9; fruit 3-angled, seeds solitary; temperate climates; astringent, purgative; contain oxalic acid and oxalates.

Genus: **1. Rheum.**

RHEUM. RHUBARB, *U.S.P.*

Rheum	**officinale,** *Baillon*, **palmatum,** *Linné*, and var., or other species grown in China and Thibet.	The dried rhizome and roots deprived of periderm tissues, yielding not less than 30 p. c. of diluted alcohol-soluble extractive.

POLYGONACEÆ

Habitat. W. and C. China, Thibet, Chinese Tartary; mountains, southern exposure—light, loose, sandy and rich black forest soil.

Syn. Turkey or China Rhubarb; Br. Rhei Rhizoma; Fr. Rhubarbe de Chine; Ger. Rhizoma Rhei, Rhabarber.

Rhe'um. L. Rha, the river Volga, upon whose banks it grows and was first found, fr. Gr. *ῥῆον*, *ῥεῖν*, to flow—*i. e.*, it causes purgation.

Of-fi-ci-na'le. L. *officina*, workshop; *opus*, work, + *facere*, to do—*i. e.*, used in or belonging to the shop or store.

Pal-ma'tum. L. *palmatus*, fr. *palma*, palm of the hand—*i. e.*, the much divided leaves.

Rhubarb, contraction of *rheubarbarum—rheum* + *barbarum—i. e.*, barbarian plant from the Rha (Volga), whence name *rha Ponticum—Pontic-rha, R. rhaponticum*, fr. Pontic or Euxine Sea.

FIG. 98.—*Rheum officinale: n*, pistils and stigmas; *d*, nectar tubes.

PLANTS.—Large compact perennial herbs; aërial stem persisting through the winter, after a few years 30 Cm. (1°) high, 10–15 Cm. (4–6′) thick, branches 25–37.5 Cm. (10–15′) long, blunt summit, brown coat from withered scales (ocreas) and leaf-bases; internally fleshy (semi-pulpy) with yellowish juice; leaves very large, petiole .3–.5 M. (12–18′) long, 2.5–4 Cm. (1–1⅗′) thick, solid; lamina .6–1.3 M. (2–4°) long and broad, suborbicular, palmately-veined, 5–7-lobed, reticulate, pubescent, pale green; stipules very large: flowering branches (stems) several, 1.5 3 M. (5–10°) high, hollow, thick, green, striate, smoothish; flowers May–June, 6 Mm. (¼′) long, clusters of 7–10, catkin-like com-

pound panicles, greenish-white; fruit August, small clusters, 12 Mm. ($\frac{1}{2}'$) long, 6 Mm. ($\frac{1}{4}'$) broad, triangular, wing at each angle, crimson-red; seed solitary. RHIZOME, subcylindrical, barrel-shaped, conical, *rounds*, or flattened pieces, *flats*, frequently with a perforation; hard, moderately heavy, 5–17 Cm. (2–7′) long, 4–10 Cm. ($1\frac{3}{5}$–4′) thick, or cut into variable shape and size; yellowish-brown, with lighter striations and occasional small patches of brown cork, more or less covered with yellowish-brown powder; fracture uneven, stellate vascular bundles, granular yellowish mottled surface; odor aromatic, agreeable; taste bitter, astringent, gritty when chewed, tingeing saliva yellow. POWDER, yellowish-brown—calcium oxalate rosette aggregates, starch grains .004–.025 Mm. ($\frac{1}{6250}$–$\frac{1}{1000}'$) broad, few tracheæ, reticulate and spiral. *Tests:* 1. Boil .1 Gm. with aqueous solution of potassium hydroxide (1 in 100) 10 cc., cool, acidulate filtrate with hydrochloric acid, shake with ether 10 cc.; ethereal layer (yellow on standing) shaken with ammonia T. S. 5 cc.—ammonia layer cherry-red color (pres. of emodin), ethereal layer remains yellow (pres. of chrysophanic acid). 2. Boil 1 Gm. + diluted alcohol 50 cc. for 15 minutes under a reflux condenser, filter, evaporate to 10 cc., cool, shake with ether 15 cc., set aside for 24 hours—yellowish prismatic crystals should not form (abs. of rhapontic rhubarb). *Solvents:* alcohol; water. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Irrespective of variety, rhubarb should be moderately heavy, compact, bright color, brittle, broken edges with fresh appearance, red and yellow veins intermingled with white, decidedly aromatic odor, bitter, astringent, slightly gritty, non-mucilaginous, staining saliva yellow; pieces that are porous, mucilaginous taste, dark brown interior should be rejected. Turmeric sometimes added to the powder and also rubbed over unsightly pieces—recognized by its starch grains, as well as by adding to 5 gr. (.3 Gm.) of suspected rhubarb a few drops of chloroform on white paper, when Chinese slightly stains the paper, while the European, or dark-colored Chinese, imparts a deep yellow stain; now on adding a few grains of borax + a drop of hydrochloric acid, if pure rhubarb—stain not changed, if tumeric present—get a distinct red.

Commercial.—Plants, resembling our garden rhubarb—pie-plant, grow wild and largely under cultivation in Chinese Empire, where a number of species, chiefly the two recognized, furnish the official product. Rhizome, when 8–10 years old, is dug in the autumn (Tartary, spring, China, Sept.–Oct.), and, after removing roots and corky layer, is divided into segments (to aid drying), perforated, strung on cords, and suspended in the shade or under cover (house roofs and eaves) to be cured by circulating air, a process that often requires a year and a loss of 80 p. c.; frequently that dried by the sun, heated stones, stoves, ovens, kilns, or brushwood fires, *high dried* (usually having broad ridges, blackish grooves, heavy disagreeable odor) and the larger roots, *tails*, are included, but both are more or less inferior.

Variety and quality are distinguished, in experienced hands, by odor (bouquet), while all kinds are subject to insect attack, which is prevented best by keeping in tightly-closed containers having a tuft of cotton saturated with chloroform or carbon tetrachloride. Most of our supply comes from Hankow, on the Upper Yang-tse, that from Hsining (Tze-chuen and Shensi products) commanding the highest price. There are three varieties: 1, *Russian* (*Turkish, Crown—R. palmatum*), no longer on the market, but consisted of the best rhizome,

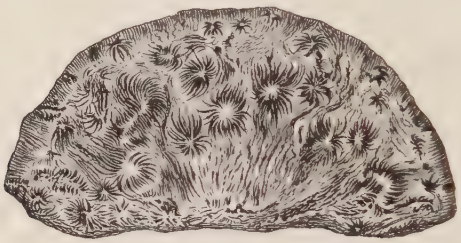


FIG. 99.—Russian rhubarb: transverse section.

from Chinese Tartary via Siberia, trimmed to beneath the cambium, perforated with large conical hole (for easy examination), inspected rigorously at Kiachta, refuse burned, the reserve sewed in linen sacks, covered with hide, and sent to Leningrad (Petrograd St. Petersburg); Turkish ports once supplied it (hence name), being brought from Tartary by caravans through Persia and Anatolia; 2, *Chinese* (*E. Indian—R. officinale, R. palmatum*, var. *tanguticum*, etc.), our official rhizome, having inner bark, and sometimes patches of rough corky layer and twine fibers; color less bright and odor less aromatic than Russian; flourishes best at

FIG. 100.—Chinese rhubarb: transverse section.

2,400–3,000 M. (8,000–10,000°) elevation in the Himalaya and other mountains, on the shady side of damp ravines, with northern exposure; distinguished natively as "northern" and "southern," also as "Shensi" (best, most expensive—orange color, agreeable odor), "Canton" (smoky odor, bitter, ochre-yellow), "Shanghai" (smoky odor, light yellow; exported chiefly from Canton, occasionally via India; 3, *European* (*Rhaponticum—R. palmatum, R. rhaponticum, R. compactum, R. undulatum, R. Emodi* +), cultivated in England, France, Austria

(Moravia), the rhizome being cut to resemble the Chinese, but differing in having the outside nearly or entirely without white meshes, the medullary rays interrupted, narrow, nearly straight, with paler color, weaker odor, and less gritty but more mucilaginous taste; rarely imported.

CONSTITUENTS.—Resin, Aloe-emodin, Chrysophanic acid, rhein, emodin, emodin monomethyl ether, rheinolic acid (new anthraquinone derivative), volatile oil, rheotannic acid, gallic acid, cinnamic acid, palmitic acid, stearic acid, oleic acid, linolic acid, verosterol (phytosterol), dextrose, levulose, calcium oxalate 2–40 p. c. (the greater the amount, the greater the activity of the drug, the two going hand in hand); starch, ash 12–13 p. c.—very inferior 35–45 p. c.

Resin.—Chief purgative principle; amorphous, non-glucosidic—obtained from alcoholic extract, after removing volatile oil, by separating from greenish-yellow residue in still the dark aqueous liquid, extracting it with ether, then with amyl alcohol, evaporating to get brown tarry liquid and yellowish granules, crystals (aloe-emodin, chrysophanic acid, rhein, emodin, emodin monomethyl ether, rheinolic acid—all of which the resin yields upon hydrolysis); evaporate brown tarry filtrate, dissolve in alcohol and precipitate with equal quantity of chloroform.

Aloe-emodin and Chrysophanic Acid.—Both slightly purgative, obtained by concentrating above ethereal liquid, heating residue with ethyl acetate, adding petroleum, decanting from tarry precipitate, evaporating petroleum solution, dissolving in ether, extracting with 10 p. c. aqueous solution of sodium carbonate (aloe-emodin), or with 10 p. c. aqueous solution of potassium hydroxide (chrysophanic acid). Aloe-emodin is the rhabarberon and iso-emodin of some writers.

FIG. 101.—European rhubarb: transverse section.

PREPARATIONS.—1. *Extractum Rhei.* Extract of Rhubarb. (Syn., Ext. Rhei., Powdered Extract of Rhubarb, Extractum Rhei Alcoholicum; Fr. Extrait de Rhubarbe; Ger. Rhabarberextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 80 p. c. alcohol until exhausted, reclaim alcohol, continue distillation until residue syrupy consistence, transfer to a dish, rinse still with little warm menstruum, which add to dish and evaporate to dryness at 70° C. (150° F.), stirring frequently; add dried starch enough for extract to weigh 50 Gm., pulverize, mix thoroughly, pass through fine sieve; 1 Gm. represents 2 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 3–10 (.2–.6 Gm.).

2. *Fluidextractum Rhei.* Fluidextract of Rhubarb. (Syn., Fldext. Rhei, Fluid Extract of Rhubarb; Fr. Extrait fluide de Rhubarbe; Ger. Rhabarberfluidextrakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126; menstruum: 80 p. c. alcohol. Dose, ♏v–30 (.3–2 cc.).

Preps.: 1. *Syrupus Rhei.* Syrup of Rhubarb. (Syn., Syr. Rhei; Fr. Sirop de Rhubarbe; Ger. Rhabarbersirup (saft).)

Manufacture: 10 p. c. Mix fluidextract of rhubarb 10 cc., spirit of cinnamon .4 cc., add potassium carbonate 1 Gm., dissolved in water 5 cc., and to this mixture add syrup q. s. 100 cc. Dose, ʒj–4 (4–15 cc.).

2. *Mistura Rhei Alkalina,* Neutralizing Cordial, *N. F.,* 1.6 p. c.

3. *Mistura Rhei Composita,* Mixture of Rhubarb and Soda, *N. F.,* 1.5 p. c. 4. *Elixir Catharticum Compositum, N. F.,* 6.2 p. c.

3. *Pulvis Rhei Compositus.* Compound Powder of Rhubarb. (Syn., Pulv. Rhei Co., Gregory's Powder, Powder Magnesia and Rhubarb, Pulvis (Infantum) Antacidus; Fr. Poudre de Rhubarbe composée; Ger. Pulvis Magnesiæ cum Rheo, Kinderpulver.)

Manufacture: 25 p. c. Triturate together rhubarb 25 Gm., ginger 10, add gradually magnesium oxide 65; mix thoroughly, pass through No. 60 sieve. It is pinkish-white, mobile, darker on exposure to moisture; it exhibits fine particles of magnesium oxide, numerous elliptical starch grains (ginger), .005–.06 Mm. ($\frac{1}{500}$–$\frac{1}{400}$′) broad, and fragments of vegetable tissues; polygonal starch grains (rhubarb), .002–.02 Mm. ($\frac{1}{1250}$–$\frac{1}{250}$′) broad. Dose, ʒss–1 (2–4 Gm.).

4. *Tinctura Rhei.* Tincture of Rhubarb. (Syn., Tr. Rhei; Fr. Teinture de Rhubarbe; Ger. Rhabarbertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104; 1st menstruum: glycerin 10 cc., alcohol 50, water 40, 2d: diluted alcohol q. s. 100 cc. Dose ʒss–4 (2–15 cc.): Prep.: 1. *Mistura Opii et Rhei Composita, N. F.,* 10 p. c.

5. *Tinctura Rhei Aromatica.* Aromatic Tincture of Rhubarb. (Syn., Tr. Rhei Arom.; Fr. Teinture de Rhubarbe aromatique; Ger. Aromatische Rhabarbertinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104 —using rhubarb 20 Gm., cinnamon 4, clove 4, myristica 2; 1st menstruum: glycerin 10 cc., alcohol 50, water 40, 2d: diluted alcohol q. s. 100 cc. Dose, ʒss–4 (2–15 cc.).

Prep.: 1. *Syrupus Rhei Aromaticus.* Aromatic Syrup of Rhubarb. (Syn., Syr. Rhei. Arom., Spiced Syrup of Rhubarb; Fr. Sirop de Rhubarbe aromatique; Ger. Gewürtzer Rhabarbersirup (saft).)

Manufacture: 3 p. c. Dissolve potassium carbonate .1 Gm. in aromatic tincture of rhubarb 15 cc., to this add syrup q. s. 100 cc. Mix thoroughly. Dose, for a child with diarrhea, ʒj–2 (4–8 cc.).

6. *Fluidglyceratum Rhei, N.F.* 7. *Pilulæ Rhei, N.F.*, 3 gr. 8. *Pilulæ Rhei Compositæ, N.F.*, 2 gr. 9. *Pulvis Rhei et Magnesiæ Anisatus*, Compound Anise Powder, *N.F.*, 35 p. c. 10. *Tinctura Rhei Aquosa, N.F.*, 10 p. c. (11 p. c. alcohol). 11. *Tinctura Rhei Dulcis, N.F.*, 10 p. c., 1st menstruum: glycerin 10, alcohol 50, water 40, 2d: diluted alcohol. 12. *Tinctura Rhei et Gentianæ, N.F.*, 7 p. c., + gentian 1.75 p. c. (diluted alcohol). 13. *Pilulæ Antiperiodicæ, N.F.*, ½ gr. 14. *Syrupus Sennæ Aromaticus, N.F.*, 1.75 p. c. 15. *Tinctura Antiperiodica, N.F.*, ⅘ p. c. Dose, each, ʒss–2 (2–8 cc.).

Unoff. Preps.: Aromatic Fluidextract, ♏xv–60 (1–4 cc.). *Infusum Rhei* (Br.), 5 p. c., ʒiv–8 (15–30 cc.). *Liquor Rhei Concentratus*, 50 p. c., ʒss–1 (2–4 cc.). *Vinum Rhei Compositum*, 8 p. c., +, ʒj–4 (4–15 cc.). *Torrefied Rhubarb.*—By roasting, the cathartic principle is volatilized and the full astringency left behind; long boiling will effect the same result.

Properties.—Aperient, purgative, astringent, stomachic, tonic. It increases saliva, gastric juice, bile, peristalsis, vascularity, and absorption. The cathartic effect comes first (4–8 hours), due to resins (mainly pheoretin), emodin, etc.; then follows astringency from rheotannic acid; both actions being chiefly on the duodenum. The milk, urine, and sweat become colored, the first also acquiring bitterness and purgative properties. Purgation may result from its application to ulcers, abraded skin, or in poultices to abdomen.

Uses.—Diarrhea, hemorrhoids, cholera infantum, chronic dysentery, dyspepsia, thread worms. With calomel good in bilious fevers; with magnesium oxide for stomach and bowel disorders. By association with other cathartics both rendered more efficient; sometimes used with opium.

Allied Plants:

1. *Rheum rhapon'ticum.* Asia Minor, Siberia, Russia. This is cultivated as pie-plant, the leaf-petioles being used, as they possess pleasant acidulous properties; this species is the source of the cultivated European rhizome, and that of Moravia (Austria), Hungary, England, and Banbury, which is usually less than half the size of official rhubarb, conical, harder, lighter color, more bitter and astringent, less gritty; contains rhapontin, $C_{22}H_{24}O_9$. *R. undula'tum, R. compac'tum, R. Emo'di, R. austra'le, R. hyb'ridum.*—All produce handsome, but smaller, less valuable, and lighter-colored rhizomes.

2. *Ru'mex cris'pus*, or *R. obtusifo'lius, Rumex, Yellow (Curled) Dock, N.F.*—The dried root with not more than 5 p. c. of stem-bases or other foreign organic matter; Europe, N. America. Common

POLYGONACEÆ

obnoxious weeds, 30–120 Cm. (1–4°) high, coarsely angled; leaves (lower) 15–35 Cm. (6–14′) long, decreasing toward summit, lanceolate, crisped, wavy; flowers terminal panicle becoming a dense mass of rusty-brown 3-winged capsules. Root, nearly simple, few rootlets, somewhat twisted, up to 30 Cm. (12′) long, 7 Cm. (3′) thick, reddish-brown, grayish from adhering soil, annulate above, wrinkled longitudinally, indented root-scars, stem-scars or remains (hollow); fracture short, dusty, fibrous; usually split longitudinally or cut transversely, 2 Cm. ($\frac{4}{5}$′) long; odor slight; taste astringent, bitter. Powder, brownish—calcium oxalate rosettes, crystals, numerous starch grains, few fibers, tracheæ, cork cells light brown; contains (cascara-) emodin .17 p. c., chrysophanic acid (rumicin, lapathin), tannin, calcium oxalate, starch. Astringent, alterative, tonic, laxative, antiscorbutic; similar to rhubarb and sarsaparilla; cutaneous eruptions, scorbutic manifestations, itch,

Fig. 102.—*Rumex crispus.*

scrofula, syphilis, hepatic congestion, dyspepsia, intermittents; leaves used as a laxative diet, and as spinach. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Rumicis* (diluted alcohol), dose, ♏xv–60 (1–4 cc.). Decoction; Ointment.

3. *R. britan'nica, Water Dock.* The root, U.S.P. 1820–1850. Europe, naturalized in N. America. Plant 1.6–2 M. (5–6°) high, leaves lanceolate, acute, transversely veined, obscurely crenate, .3–.6 M. (1–2°) long; root more astringent but physically and medicinally similar to *R. crispus*, with which it is often indiscriminately collected. *R. sanguin'eus, Red-veined Dock.* Leaf-veins and stems reddish; *R. aqua'ticus*, fruit smooth, both astringent. *R. Acetosel'la, Field* or *Sheep Sorrel*, contains acid potassium oxalate and tartaric acid, sour taste lost upon drying; refrigerant, diuretic, good diet in scurvy.

4. *Polyg'onum Bistor'ta, Bistort.*—Europe, Asia, N. America, in meadows. Produces an S-shaped rhizome, bent upon itself—bistorted,

5 Cm. (2′) long, 15 Mm. ($\frac{3}{5}$′) thick, flattened or channeled, upper side transversely striate, root-scars on under side, red-brown; contains tannin 20 p. c., starch, calcium oxalate; tonic, astringent. Dose, gr. 5–30 (.3–2 Gm.).

Fig. 103.—*Polygonum Bistorta:* rhizome, natural size.

20. CHENOPODIACEÆ. Goosefoot Family.

Ke-no-po-di-a′se-e. L. *Chenopodi-um* + aceæ, fr. Gr. χήν, goose, + πούς, foot—*i. e.*, referring to the shape of leaves. Herbs, shrubs. Distinguished by being homely, succulent; leaves exstipulate, no bracts; flowers minute, greenish, with free calyx imbricated in the bud, persistent; 2-5-lobed; petals none; ovary 1-celled, forming 1-seeded utricle; universal, saline places; anthelmintic, antispasmodic, aromatic, carminative, stimulant (vol. oil).

Genus: **1. Chenopodium.**

CHENOPODIUM. CHENOPODIUM.

Oleum Chenopodii. Oil of Chenopodium, *U.S.P.*

Chenopodium ambrosioides, var. **anthelminticum,** *Linné.*

A volatile oil distilled with steam from the fresh, overground parts of the flowering and fruiting plant, yielding not less than 65 p. c. ascaridol ($C_{10}H_{16}O_2$).

Habitat. W. Indies, C. and S. America, waste places, roadsides; naturalized in United States, Europe, Africa; cultivated in Maryland for the oil.

Syn. American (Wild) Wormseed, Stinking Weed, Goosefoot, Jerusalem (Jesuit) Tea, Jerusalem Oak (Jak), Fructus Chenopodii Anthelmintici; Ol. Chenopod., Oil of American Wormseed; Fr. Ansérine Vermifuge (plante fleurie), Essence de Chénopode anthelmintique; Ger. Amerikanischer Wurmsamen, Wurmsamenöl, Chenopodiumöl.

Che-no-po′di-um. L. see etymology, above, of Chenopodiaceæ.

Am-bro-si-oi′des. L. fr. Gr. α, priv., not, + βροτός, mortal, + ο-ειδης, like—*i. e.*, resembling that which is immortal, once thought to effect that condition when taken.

An-thel-min′ti-cum. L. fr. Gr. ἀντί, against, + ἕλμινθα, a worm—*i. e.*, worm antagonizer or destroyer.

Plant.—Annual or perennial, .6–1.6 M. (2–5°) high; stem angular, furrowed, branched; leaves toothed, yellowish-green, gland-dotted on under surface; flowers July-Sept., greenish-yellow, dense leafy

spikes. Fruit, 2 Mm. ($\frac{1}{12}'$) thick, size of pin's head, depressed-globular, greenish-gray, integuments friable, containing a lenticular, obtusely edged, glossy, black seed; odor peculiar, terebinthinate; taste bitter, pungent. All parts of the plant have this disagreeable odor and same medicinal properties when dry and fresh; grows best in rubbish, along fences, in village streets, vacant lots, and should be collected in October.

CONSTITUENTS.—Volatile oil 3–3.5 p. c., from fresh herb .5–1 p. c.

Oleum Chenopodii. Oil of Chenopodium.—This volatile oil, obtained by distilling with water or superheated steam, is a colorless, pale yellowish liquid, peculiar, disagreeable odor, bitter, burning taste, soluble in 70 p. c. alcohol (8), sp. gr. 0.967, levorotatory; contains a terpene — pinene, $C_{10}H_{16}$, and a liquid oxygenated portion ($C_{10}H_{16}O_2$), ascaridol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–10 (.13–.6 cc.).

PREPARATIONS. — (Unoff.). FRUIT: *Fluidextract*, ♏xv–30 (1–2 cc.). *Decoction* (water or milk), ℥j–2 (30–60 cc.). FRESH PLANT: *Expressed Juice*, ʒij–4 (8–15 cc.), ter die.

FIG. 104.—*Chenopodium ambrosioides* var. *anthelminticum*.

FIG. 105.—*Chenopodium ambrosioides*.

PROPERTIES.—Anthelmintic, vermifuge, round worms (*Ascaris lumbricoides*).

USES.—While mainly for worms, it has also been used in intermittents, hysteria, chorea, nervous affections, tenia. May give the powder

incorporated with molasses or syrup, but the oil is more popular, being well taken on sugar by children. Should be given twice daily for several days, on empty stomach if possible, and follow with a dose of castor oil. Fruit, U.S.P. 1820–1890.

Allied Plants:

1. *Chenopodium ambrosioi'des, Herba Botryos Mexicanæ, Mexican Tea.*—The fruit, U.S.P. 1890; Europe, Asia. This resembles very closely the preceding plant, the latter being, however, more strongly aromatic, leaves more deeply toothed, the lower ones often nearly pinnatifid, spikes more elongated, usually leafless; fruit of both alike. *C. Bo'trys, Jerusalem Oak (Feather Geranium);* Europe, Asia. Strongly

FIG. 106.—*Phytolacca americana:* 2, single fruit, showing carpels.

aromatic; catarrh, asthma. *C. Bo'nus Henri'cus, Good King Henry;* Europe; taste saline, mucilaginous. *C. al'bum, Pig Weed (Lamb's Quarters);* taste mucilaginous, saline. *C. Vulva'ria, Fetid Goosefoot;* Europe; plant has fish-brine odor, due to trimethylamine.

2. *Phytolac'ca america'na, Phytolacca, Poke Root, N.F.*—Phytolaccaceæ. The dried root with not more than 5 p. c. of stem-bases nor 2 p. c. of other foreign organic matter; N. America, waste places. Perennial herb, 1.3–2.5 M. (4–8°) high, stem annual, 2.5–5 Cm. (1–2′) thick, purplish, hollow; leaves 12.5 Cm. (5′) long, ovate, smooth, rich-green, entire; flowers greenish-white, racemes; fruit purplish berry, 8 Mm. ($\frac{1}{3}$′) thick, 10-seeded, juice purplish-red. Root, cylindrical,

CHENOPODIACEÆ

3–7 Cm. (1–3′) thick, transverse or longitudinal slices, yellowish-brown, longitudinally wrinkled, annulate; internally fibro-vascular tissue and parenchyma, the latter much retracted; odor slight, taste sweetish, acrid. Powder, brownish-yellow, sternutatory—starch grains, calcium oxalate raphides, fragments of parenchyma, tracheæ, cork tissue; solvents: diluted alcohol, boiling water; contains glucoside—active, poisonous, saponin-like—starch, sugar, calcium oxalate (phytolacc-ine, -in, -ic acid). Alterative, laxative, emetic, resolvent, anodyne, paralyzant; rheumatism, skin diseases, syphilis, ulcers, scabies, eczema, tonsillitis, diphtheria. *Poisoning:* Symptoms and treatment similar to aconite. Dose, alterative, gr. 1–5 (.06–.3 Gm.), emetic, gr. 10–30 (.6–2 Gm.); 1. *Fluidextractum Phytolaccæ* (diluted alcohol), dose, ♏v–30 (.3–2 cc.); 2. *Fluidextractum Trifolii Compositum*, 10 p. c. *Decoction*, 5 p. c., ℥iv–8 (15–30 cc.); *Tincture*, 10 p. c., ♏x–60 (.6–4 cc.). *P. octan'dra*, C. and S. America, and *P. acino'sa*, N. India, are used similarly. All of these furnish young shoots which in spring may be eaten for asparagus, spinach, etc., imparting no odor to urine, but when old none should be taken except in medicinal doses.

Fig. 107.—Phytolacca root: transverse section, natural size.

3. *Magno'lia virginia'na* (*glau'ca*), *M. acumina'ta*, and *M. tripet'ala*. —Magnoliaceæ. The bark, U.S.P. 1820–1880: United States; trees 6–28 M. (20–90°) high; flowers white, fragrant; fruit cones; bark in thin quills or curved pieces, orange-brown, glossy, warty, fissured, astringent,

Fig. 108.—*Magnolia acuminata.*

bitter; contains volatile oil, resin, magnolin, tannin. Used for malaria, rheumatism, gout, intermittents, catarrhs; in decoction, infusion, tincture. Dose, ʒss–1 (2–4 Gm.).

4. *Lirioden'dron Tulipif'era, Tulip-tree.*—The bark, U.S.P. 1820–1870; United States, China; tree 18–45 M. (60–150°) high; flowers yellowish; fruit cone, 7.5 Cm. (3′) long. Bark in quills or curved pieces 2 Mm. ($\frac{1}{12}$′) thick, purplish-brown, thin ridges, inside whitish,

smooth, astringent; contains volatile oil, resins, liriodendrin, tulipiferine, tannin; injured by boiling. Used for chronic rheumatism, dyspepsia, intermittent fever; in infusion or fluidextract. Dose, ʒss–1 (2–4 Gm.).

a *b* *c*

FIG. 109.—*Illicium verum: a*, flower; *b*, fruit carpels of the flower magnified; *c*, fruit.

5. *Illic'ium ve'rum, Star Anise.*—The fruit, U.S.P. 1880–1890; N. Annam, S. W. China (mountains). Small tree, 3–6 M. (10–20°) high, branched; leaves evergreen, lanceolate, pointed, entire, pellucid-punctate, 5–15 Cm. (2–6′) long; flowers greenish-yellow. Fruit (capsule—integuments 87 p. c., seed 22 p. c.), star-shaped, being composed of 8 stellately arranged boat-shaped carpels, 8 Mm. (⅓′) long, woody, wrinkled, brown, dehiscent on upper suture; internally each carpel glossy, reddish-brown, containing 1 flattish, oval, glossy-brown seed; odor anise-like (*anisatum*); taste sweet, aromatic—seed oily; contains (integuments) — volatile oil (one of the sources of Oleum Anisi, U.S.P.) 5.3 p. c. (congeals at

FIG. 110.—*Illicium religiosum* (*anisatum*).

FIG. 111.—*Drimys Winteri.*

1° C.; 34° F., and consists chiefly of anethol), resin 10.7 p. c., fixed oil 2.8 p. c., saponin, protocatechuic acid, shikimic acid, mucilage, ash 2 p. c.; (seed)—volatile oil 1.8 p. c., resin 2.6 p. c., fixed oil 20 p. c.; solvents: alcohol, hot water partially. *Adulteration:* Poisonous fruit

MYRISTICACEÆ

of the allied species, *Illicium religiosum* (*anisatum*). Carminative, anodyne, stimulant, diuretic; flatulent colic, indigestion, infantile catarrh, bronchitis, rheumatism, earache, flavoring. Dose, gr. 5–30 (.3–2 Gm.); infusion, 5 p. c., ʒj–2 (30–60 cc.); volatile oil ♏j–2 (.06–.13 cc.).

6. *I. religio'sum* (*anisa'tum*).—Cultivated around Buddhist temples in China and Japan, being called *Shikimi*. Fruit very similar to the preceding, having 8 carpels, but is more woody and shriveled, with thin, upward-curved beak; odor faint, clove-like; taste unpleasant; contains .44 p. c. of a non-solidifying volatile oil, sp. gr. 0.990, shikimic acid, sikimipicrin (crystalline, bitter), and sikimin (poisonous). The oil consists of a terpene, safrol, $C_{10}H_{10}O_2$, eugenol, $C_{10}H_{12}O_2$, and liquid anethol. The fruit is used natively for killing rats, fish, etc., the latter serving as food in spite of the poison. Upon persons it causes vomiting, epileptiform convulsions, and dilated pupils; *I. florida'num* and *I. parviflo'rum;* Fla., Ga., La.; the former has fruit with 13 carpels, the latter with only 8; barks are substituted sometimes for cascarilla.

5. *Dri'mys Win'teri* (*Win'tera aroma'tica*).—The bark, U.S.P. 1820–1860; S. America; small tree; leaves coriaceous; flowers white; fruit black berries, 4–8; bark in quills or curves, 2.5–8 Mm. ($\frac{1}{10}$–$\frac{1}{3}$′) thick, grayish-brown, striate, fracture granular, with white stone cells and yellow resin cells, odor of canella and cinnamon, for which drugs it has been substituted; sometimes called Winter's cinnamon; contains volatile oil (which has winterene, $C_{15}H_{24}$), tannin 9 p. c., pungent resin 10 p. c. Used for colic, flatulence, scurvy; in infusion or tincture. Dose, gr. 5–30 (.3–2 Gm.).

21. MYRISTICACEÆ. Nutmeg Family.

Mi-ris-ti-ka′se-e. L. *Myristic-a* + aceæ, fr. Gr. μυρίζειν, to anoint—*i. e.*, an ointment used for its sweet odor. Trees. Distinguished by aromatic properties: leaves dotted, entire, stalked, leathery: flowers regular, dicœcious, calyx 3–4-cleft, leathery, inferior; filaments 3–12, united, ovary 1-celled, ovule 1; fruit succulent, seeds oily; tropics; aromatic, seeds the strongest; bark and pericarp acrid.

Genus: **1. Myristica.**

MYRISTICA. MYRISTICA, *U.S.P.*

Myristica fragrans, *Houttuyn.*

The dried ripe seed deprived of seed-coat—the kernel, with or without thin coating of lime, yielding not less than 25 p. c. non-volatile, ether-soluble extractive, nor more than .5 p. c. acid-insoluble ash.

Habitat. Molucca Islands; cultivated in tropics, India, Philippine Islands, Amboyna, Boura, New Guinea, E. Indies, W. Indies, S. America, Ceylon, Sumatra, Java, etc.

Syn. Myrist., Nutmeg, Round Nutmeg; Fr. Muscade des Moluques, Noix Muscade, Nux Muschata, Nuces Nucistæ; Ger. Semen Myristicæ, Muskatnuss, Myristicasamen.

My-ris'ti-ca. L. see etymology, page 190, of Myristicaceæ.

Fra'grans. L. *fragran(t)s*, sweet-scented—*i. e.*, from its fragrant odor.

Nut'meg. OE, *nut* + *muge*, musk, corrupted into *meg*—*i. e.*, from its odor.

PLANT.—Evergreen tree 7.5–15 M. (25–50°) high, much branched, bark brownish-gray, smooth, young branches green; leaves leathery, smooth, entire, 10–15 Cm. (4–6′) long, acute at both ends, prominently veined, dark green; flowers diœcious, small, yellow, fruit pendulous, smooth, yellow, 7.5 Cm. (3′) long, 5 Cm. (2′) wide, resembling a peach, but grooved by a longitudinal furrow, pericarp, 12 Mm. ($\frac{1}{2}$′) thick, tough, fleshy, with astringent juice, yellowish-white, dehiscing from above along the furrow into 2 equal valves that become dry and coriaceous when ripe, and from between which readily falls out the erect, blunt, single seed closely enveloped, reticulately furrowed and almost completely covered by an irregularly cut fleshy arillus (mace); when deprived of this latter the seed-testa is dark brown, hard, thick, smooth, shining, woody; inner seed-coat thin, membranous, pale brown. KERNEL (myristica, nutmeg), ovoid, ellipsoidal, 20–30 Mm. ($\frac{4}{5}$–$1\frac{1}{5}$′) long, 15–20 Mm. ($\frac{3}{5}$–$\frac{4}{5}$′) thick, light brown, reticulately furrowed from the tightly oppressed arillus, broad end with large circular, upraised scar from which arises a groove extending to a depression at opposite end (chalaza), easily cut, surface having waxy luster, mottled from light brown perisperm penetrating into the yellowish-brown endosperm; longitudinal section through endosperm above large scar shows cavity with shrunken remains of embryo and usually with a growth of mold; odor characteristically aromatic; taste pungently aromatic. POWDER, reddish-brown—fragments of perisperm with reservoirs containing volatile oil, parenchyma cells filled with aleurone and starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad—blue with iodine T. S., whereas starch in mace—yellowish-red; occasional tracheæ; mounts in chloral hydrate T. S.—shows numerous globules of fixed oil, which may separate in rod-like crystals; mounts in fixed oil—show separated aggregates of crystals which strongly polarize light; powder from "limed" nutmegs under microscope, upon adding water containing 25 p. c. of sulphuric acid—show separation of calcium sulphate crystals (needles, short rods) which do not polarize light. Some accept the hard testa and kernel as the seed, like peach seed, but the U.S.P. recognizes solely the kernel or nucleus, that central part left after the fleshy portion, arillus, and hard testa have been removed. Those that are broken, of light weight, feeble odor and taste, musty, wormy and black-veined should be rejected. *Solvents:* alcohol; ether. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—KERNELS: Rare—those punctured, boiled, and plugged, recognized by lightness, insect ravages, and pegs (on breaking open); also false nutmegs, in spite of easy detection; Papua (large), Macassar (small)—*M. fatua* and *M. argentea*—both longer, more

narrow and pointed, the former with little aroma after drying, the latter more brittle and aromatic, and furrowed with 4 broad stripes. Powder (Ground): Common—partially or wholly exhausted refuse, from percolation or distillation.

Commercial.—Plant prefers light soil, shade, and moist climate, produces fruit when 8–9 years old, matures at 25, and yields annually for 60–70 years. Fruit was unknown to the ancients, Avicenna being the first to notice it, and is collected when split on one or both sides, Sept.–Dec., (also April–June) by means of a hook on a long pole, or by hand, placed into baskets, pericarp and arillus removed, and the

Fig. 112.—*Myristica fragrans:* twig with the fruit.

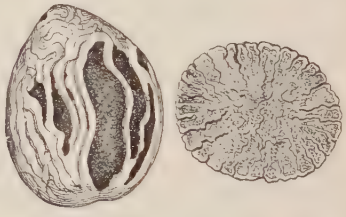


Fig. 113.—Nutmeg, with mace, and transverse section.

Fig. 114.—Wild nutmeg, with mace.

seed, spread on frames to dry by sun or fire at 60° C. (140° F.), being turned over every few days for 2 months. When kernels rattle in the shells, the latter are cracked off with mallets, and the former assorted, the best being rubbed over with powdered lime and packed in white-washed casks or chests for market. The Chinese are supplied with uncracked seed, while inferior grades are utilized for expressing the fixed oil. There are several varieties: 1, *Unlimed* (*Brown, Penang, Singapore*), as above described, sometimes oily to the touch, and mixed with clove; 2, *Limed* (*Dutch, Batavian*), prepared in the Banda Islands by steeping the dried seed for a short time in a mixture of salt water

and lime (a protection against insect attacks, and possibly to kill the embryo thereby restricting the culture to their own provinces), then exposing to the sun several days and packing for market; 3, *Artificial*, prepared by compressing a mixture of earthy and powdery matter, being less aromatic than the genuine, also soft and crumbly when in boiling water 3 minutes; contains volatile oil 2 p. c., fat 15 p. c., ash 11–18 p. c.

CONSTITUENTS.—Volatile oil 2–8–15 p. c., fixed oil 25–30 p. c., starch, proteins, mucilage, ash 2–5 p. c.

Oleum Myristicæ. Oil of Myristica, *U.S.P.*—(Syn., Ol. Myrist., Myristica Oil, Oil of Nutmeg, Oleum Nucistæ Ætheream; Fr. Essence de Muscade; Ger. Oleum Macidis, Ätherisches Muskatnussöl.) This volatile oil, distilled from the dried kernels of the ripe seed with water or steam, is a colorless, pale yellow liquid, characteristic odor and taste of nutmeg; soluble in alcohol (1), in 90 p. c. alcohol (3), sp. gr. 0.859–0.924, dextrorotatory; contains *d*-pinene and *d*-camphene 80 p. c., dipentene 8 p. c., eugenol, safrol, myristicol, $C_{10}H_{16}O$, and myristicin, $C_{12}H_{14}O_3$. The nutmeg camphor (once thought to be myristin), which sometimes settles on standing, is myristic acid. *Tests:* 1. Evaporate 3 Gm. on water-bath—residue .06 Gm. 2. Recently distilled oil in alcohol (1)—neutral or only slightly acid. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–3 (.13–.2 cc.).

Fixed Oil. (Oleum Myristicæ Expressum, Oleum Nucistæ.)—Obtained by bruising nutmegs, exposing them in a bag to steam, and expression between heated plates; the oil runs out a liquid, but congeals upon cooling; often called *nutmeg butter*, and improperly *oil of mace;* it is an orange-brown solid, sp. gr. 0.995, melting at 45° C. (113° F.), soluble in hot ether (2), hot alcohol (4); consists mainly of myristin, with some myristic acid, palmitin, olein, resin, volatile oil 6 p. c. Dose, gr. 2–5 (.13–.3 Gm.).

PREPARATIONS.—I. SEED: 1. *Tinctura Lavandulæ Composita*, 1 p. c. 2. *Tinctura Rhei Aromatica*, 2 p. c. 3. *Pulvis Aromaticus, N.F.*, 15 p. c. 4. *Pulvis Cretæ Aromaticus, N.F.*, 6 p. c. 5. *Syrupus Sennæ Aromaticus, N.F.*, $\frac{1}{5}$ p. c. II. OIL: 1. *Spiritus Ammoniæ Aromaticus*, $\frac{1}{10}$ p. c. 2. *Elixir Pepsini et Rennini Compositum, N.F.*, $\frac{1}{100}$ p. c. 3. *Mistura Oleo-Balsamica, N.F.*, $\frac{2}{5}$ p. c. *Spiritus Myristicæ* (Br.), 10 p. c. Dose, ♏v–20 (.3–1.3 cc.).

PROPERTIES.—Stimulant, stomachic, narcotic, flavoring, condiment, increases gastric juice, digestion, appetite; large doses, like camphor, act on the cerebrum, causing stupor, delirium.

USES.—Flatulence, gastric debility, diarrhea, dysentery, vomiting, colic, dyspepsia, flavoring, condiments.

Allied Products:

1. *Macis, Mace.*—The arillode of the seed of *Myristica fragrans*, U.S.P. 1850–1900. When fruit first gathered the fleshy pericarp is removed, the thin coating (arillode) enveloping the seed peeled off with a knife, then sprinkled with salt water, as a preservative, and

dried by sun or fire; or it may be allowed to remain on the seed until thoroughly dry, when it freely cracks and peels off. It is a brilliant, scarlet (fresh), or brownish-orange (dry), brittle, in narrow bands, 2.5 Cm. (1′) long, branched, lobed above, fatty when scratched or pressed, fracture short, showing many oil-cells; odor fragrant; taste warm, aromatic; contains volatile oil (oleum macidis) 4–9–17–35 p. c., resin 25 p. c., sugar 1 p. c., amylodextrin 1.8 p. c., fixed oil, mucilage, proteins (no starch), ash 1–3 p. c.; solvent: alcohol. Tinctura Macidis, 20 p. c. (alcohol). *Adulterations:* Common (entire and powdered)—nutmeg, starch, ginger, and mace of *M. malabar'ica* and *M. fatua;* this latter readily being detected by darker reddish color, more fatty, resinous, lustrous surface, weaker taste and odor, yielding 10 times more ether-extract, and microscopic specimen turning dark brown with potassium hydroxide solution, becoming yellow with sulphuric acid. Stimulant, tonic, flavoring. Dose, gr. 5–20 (.3–1.3 Gm.).

2. *False, Long, Wild, Male Nutmegs—M. fat'ua* and *M. argen'tea.*—These are 4–5 Cm. ($1\frac{3}{5}$–2′) long, paler and less aromatic than official, the mace inodorous and less deeply lobed.

22. RANUNCULACEÆ. Crowfoot Family.

Ra-nung-ku-la'se-e. L. *Ranuncul-us* + aceæ, dim. of *rana,* a frog; hence little frog, as many species grow in moist places near that reptile. Herbs, shrubs with colorless, acrid, poisonous juice. Distinguished by flowers being regular or irregular, most complete; organs all distinct; no adhesion or cohesion; often yellow; sepals 3–15, mostly 5 (often petaloid); petals 3–15; only 1 circle; stamens many, hypogynous; pistils distinct; seeds albuminous, superior; temperate climates; narcotic, bitter, tonic, poisonous.

Genera: **1. Hydrastis. 2. Cimicifuga. 3. Aconitum.**

HYDRASTIS. HYDRASTIS, *U.S.P.*

Hydrastis canadensis, *Linné.*

The dried rhizome and roots with not more than 2 p. c. stems and leaves, nor 2 p. c. other foreign organic matter, yielding not less than 2.5 p. c. ether-soluble alkaloids, nor more than 3 p. c. of acid-insoluble ash.

Habitat. N. America, Canada, east of the Mississippi; rich woodlands, mountains.

Syn. Golden Seal, Yellow (Orange) Root, Yellow Puccoon (Indian Paint), Turmeric (Jaundice) Root, Ohio Curcuma, Indian Turmeric (Dye), Ground Raspberry, Eye Balm (Root), Yellow Eye; Br. Hydrastis Rhizoma; Fr. Racine Orange, Sceau d'Or; Ger. Hydrastisrhizom, Canadische Gelbwurzel.

Hy-dras'tis. L. fr. Gr. ὕδωρ, water, + δράω to act—*i. e.,* alluding to the active properties of the juice, or to the plants growing in marshy places.

Can-a-den'sis. L. of Canada—*i. e.,* its northern habitat limit.

Golden Seal—i. e., its yellow scarred rhizome, once used as a paint and dye.

PLANT.—Perennial herb 15–30 Cm. (6–12′) high, simple, hairy, 2-leaved near apex, one sessile at top, the other an inch or so below with thick petiole; leaves pubescent, round, cordate, palmately 5–7-lobed, pointed, serrate, 10–22.5 Cm. (4–9′) wide; flowers May–June, only one, greenish-yellow, arising from upper leaf on a peduncle; fruit compound red berry, 12 Mm. ($\frac{1}{2}$′) thick, composed of 12 or more 1–2-seeded berries like raspberry. RHIZOME, horizontal or oblique growth, subcylindrical, flexuous, 1–5 Cm. ($\frac{2}{5}$–2′) long, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′)

FIG. 115.—*Hydrastis canadensis: A*, rhizome, stem, etc.; *B*, flower; *C*, petal; *D*, stamen; *E*, fruit carpel, longitudinal section; *F*, seed.

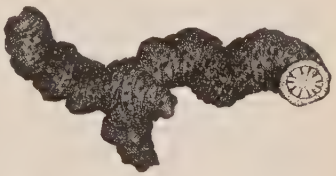


FIG. 116.—*Hydrastis canadensis:* rhizome.

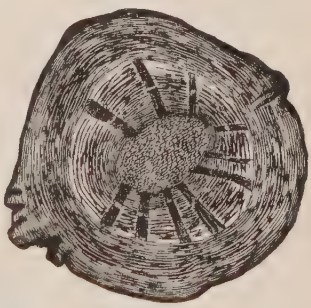


FIG. 117.—Hydrastis rhizome: transverse section, magnified.

thick, grayish-brown, longitudinally wrinkled, annulate from scars of bud-scales; upper surface occasionally with stem- or leaf-bases, many stem-scars; under and lateral surfaces with easily detached filiform roots, up to 35 Cm. (14′) long, and 1 Mm. ($\frac{1}{25}$′) thick; yellowish; brittle; curved, twisted, matted, or broken; fracture short, waxy; internally deep yellow, or greenish-yellow, enclosing an interrupted circle of small fibro-vascular bundles; odor distinctive; taste bitter. POWDER, brownish-yellow—numerous starch grains, .002–.015 Mm. ($\frac{1}{1250}$–$\frac{1}{1650}$′) broad, parenchyma and fragments of tissues with fibro-vascular

bundles, tracheæ, tabular cork cells, no calcium oxalate crystals. *Test:* 1. Moistened with water, mounted directly in sulphuric acid shows numerous acicular, or rod-shaped crystals. *Solvents:* alcohol; diluted alcohol; boiling water. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Rhizomes of *Aristolochia Serpentaria, Aristolochia reticulata, Cypripedium hirsutum, Cypripedium parviflorum, Asarum canadense, Xanthorrhiza apiifolia,* and roots of *Styloph'orum diphyl'lum.*

Commercial.—The Cherokee Indians used hydrastis very early as a domestic remedy and dye, and although they disclosed its value to the American settlers, it did not attract medical attention until 1798, but soon thereafter became popular with the "Eclectics" and later one of our important drugs.

CONSTITUENTS.—Hydrastine 1.5–3.14 p. c., Berberine 3–4 p. c., Canadine (resin, fluorescent compound, starch, sugar, gum, fat, coloring matter), ash 5 p. c.

Hydrastina, Hydrastine, $C_{21}H_{21}O_6N$.—This characteristic colorless alkaloid is obtained by adding hydrochloric or sulphuric acid in excess to an alcoholic tincture of hydrastis, whereby the corresponding berberine salt deposits in crystals; to the filtered mother-liquor add ammonia water until acidity is nearly neutralized, strain to remove ammonium salt, concentrate to a syrupy consistence and pour this into 10 volumes of cold water, to remove fat and resin; to the filtrate, containing crude hydrastine salt, add ammonia water in excess to precipitate impure alkaloid, which may be purified by dissolving in diluted sulphuric acid, again precipitating with ammonia water and repeated crystallization from hot alcohol; also prepared synthetically; occurs in white, creamy white, glistening prisms, white microcrystalline powder, permanent, soluble in benzene, alcohol (170), hot alcohol (22), chloroform (1.4), ether (175); insoluble in water; saturated alcoholic solution alkaline, melts at 131° C. (268° F.). Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Hydrastinæ Hydrochloridum, Hydrastine Hydrochloride, $C_{21}H_{21}O_6N.HCl$, *N.F.*—The hydrochloride of the alkaloid hydrastine obtained by dissolving the pure alkaloid in alcoholic solution of hydrochloric acid, concentrating until crystals appear; occurs as a white, creamy-white powder, odorless, hygroscopic; soluble in water, alcohol, slightly in chloroform, ether; aqueous solution (1 in 20) neutral, slightly acid. *Tests:* 1. With silver nitrate T. S.—white precipitate, insoluble in nitric acid; with sulphuric acid—yellow color, changing to purple on heating. 2. With sulphuric acid containing .005 Gm. molybdic acid in each cc.—green, olive-green, brown: substitute selenous acid for molybdic acid—light green color, changing to brown; with nitric acid—reddish-yellow color; incinerate .1 Gm.—ash non-weighable. 3. Solution of .1 Gm. in diluted sulphuric acid 10 cc.—no blue fluorescence (abs. of hydrastinine), but gradually adding potassium permanganate T. S., avoiding excess—blue fluorescence develops. 4. Aqueous solu-

tion (1 in 20)—not reddened by chlorine water (abs. of berberine). Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Hydrastininæ Hydrochloridum, Hydrastinine Hydrochloride, $C_{11}H_{11}O_2N.HCl$.—This hydrochloride of the artificial alkaloid is obtained by the oxidation of hydrastine with an oxidizing agent (nitric acid, potassium dichromate or permanganate, etc.) in acid solution; dissolve hydrastine 10 Gm. in nitric acid 75 cc., heat to 60° C. (140° F.), upon cooling opianic acid crystallizes out, add to filtrate potassium hydroxide solution to precipitate hydrastinine, purify by recrystallizing from benzene or acetic ether, dissolve crystals in hydrochloric acid, crystallize from alcohol; occurs in light yellowish needles, yellowish-white, crystalline powder, odorless; soluble in water, alcohol, chloroform (195), ether (1820); aqueous solution (1 in 20) neutral, with blue fluorescence, especially when highly diluted, melts at 210° C. (410° F.) with partial decomposition. Used chiefly for uterine hemorrhage (hypodermically), also as oxytocic; slows heart, but increases force of contraction, motor-depressant, paralyzant. Dose, gr. $\frac{1}{3}$–$\frac{1}{2}$ (.02–.03 Gm.), in 10 p. c. solution.

Berberine, $C_{20}H_{17}O_4N$.—This colored alkaloid is obtained by the preceding process for separating hydrastine; occurs in bitter yellow needles, crystalline powder, soluble in hot water or alcohol; the hot alcoholic solution with iodine gives dark green lustrous scales; forms several yellow salts, carbonate, hydrochloride, phosphate, sulphate, etc., which dissolve in water with difficulty; found also in berberis, calumba, coptis, menispermum, xanthorrhiza, etc. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

Canadine, $C_{20}H_{21}O_4N$.—This forms white needles; in alcohol solution, with iodine get yellow crystals; it is called sometimes tetrahydroberberine, and differs from hydrastine in being more soluble in acetic ether and alcohol; only the hydrochloride and sulphate are easily soluble in alcohol or hot water; the name xanthopuccine once assigned to it, but as such it was very likely impure berberine.

Preparations.—I. Rhizome: 1. *Fluidextractum Hydrastis.* Fluidextract of Hydrastis. (Syn., Fldext. Hydrast., Fluid Extract of Hydrastis, Fluidextract of Golden Seal; Br. Extractum Hydrastis Liquidum; Fr. Extrait fluide d'Hydrastis; Ger. Hydrastisfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st menstruum: alcohol 60 cc., water 20, glycerin 10; 2d: 67 p. c. alcohol; reserve first 75 cc., in which dissolve soft extract, assay and add 2d q. s. for 100 cc. to contain 1.8–2.2 Gm. of ether-soluble alkaloids. Dose, ♏v–30 (.3–2 cc.): Preps.: 1. *Mistura Rhei Alkalina, N. F.,* $\frac{4}{5}$ p. c.

2. *Elixir Hydrastis Compositum,* Alkaline Elixir, *N. F.,* fldext. 1.75 p. c. + fldexts. oat, xanthox. āā 1.75, fldexts. gentian, ginger āā .875, sodium bicarb. .875, elix. arom. q. s. 100.

2. *Extractum Hydrastis, N. F.;* yields 9–11 p. c. of ether-soluble alkaloids, and 1 Gm. represents 4 Gm. of hydrastis. Dose, gr. 1–10 (.06–.6 Gm.). 3. *Tinctura Hydrastis, N. F.,* 20 p. c. (67 p. c. alcohol). Dose,

RANUNCULACEÆ

℥ss–1 (2–4 cc.). II. HYDRASTINE: 1. *Liquor Hydrastinæ Compositus*, Colorless Hydrastine Solution, *N. F.*, $\frac{3}{10}$ p. c. Dose, ℥ss–1 (2–4 cc.).

Unoff. Preps.: Decoction, 5 p. c., ℥j–2 (30–60 cc.). *Hydrastin* of "Eclectics" is a resinoid, prepared by exhausting the drug with alcohol, evaporating, and precipitating with acidulated (HCl) water; it is chiefly berberine chloride, which often occasions for it the substitution of the pure hydrochloride of that alkaloid, dose, gr. 2–6 (.13–.4 Gm.).

PROPERTIES.—Upon digestion, circulation, respiration, and nervous system analogous to, but much milder than, strychnine. Bitter tonic, increases appetite, digestion, gastric secretions (berberine), and the

FIG. 118.—*Helleborus viridis:* 1, receptacle, tricarpelled ovary, and stamens; 2, a stamen; 3, the three resulting ripened fruits; 4, a seed.

flow of bile; antiperiodic, protoplasmic poison, interfering with the white blood-corpuscle movement, alterative to the mucous membranes, deobstruent to the glandular system, antiseptic, cholagogue, diuretic. Hydrastine acts on the nervous system like quinine, but it is non-toxic, as large doses only produce warmth in the stomach and ringing in the ears.

USES.—Chronic dyspepsia and cystitis, catarrhs of the stomach, duodenum, gall-ducts, bladder, uterus and vagina, constipation, bronchitis, malaria, intermittent fever, jaundice. Locally in gonorrhea, leucorrhea, otorrhea, gleet, chronic nasal catarrh and pharyngitis,

syphilitic sores in the mouth, nares, and throat, unhealthy intractable ulcers and sores, cancers, fistulas, hemorrhoids, fissured nipples, conjunctivitis, tonsillitis, hemorrhage. Hydrastine for chronic malaria is much weaker, but next in value to quinine; hydrastinine (hypodermically) for menorrhagia and metrorrhagia. The yellowish liquids are objectionable owing to their staining qualities, for which, however, the Indians valued them in dyeing fabrics yellow; with indigo they impart a fine green to wool, silk, and cotton.

Poisoning: Same as for nux vomica and strychnine.

Incompatibles: Alkalies, mineral acids, tannic and other vegetable acids, chloral hydrate, potassium bromide, motor depressants.

Synergists: Quinine and the vegetable tonics upon the stomach, ergot upon the uterus, and strychnine upon the spinal cord.

Allied Plants:

1. *Cop'tis trifo'lia, Coptis, Goldthread, N.F.*—The dried plant with not more than 3 p. c. of foreign organic matter; N. America, damp, mossy woods. Plant with scape 7.5–12.5 Cm. (3–5′) high, leaves radical, 3-foliate; evergreen, obovate-cuneate, coriaceous, flowers May, whitish; fruit 7 follicles, seed black. Rhizome, in loose, matted masses (rhizome, roots, leaves), golden-yellow; odor faint; taste bitter without astringency. Powder, yellowish-green—starch grains, elliptical stomata, chloroplastids, root cells with reddish contents, tracheæ; contains berberine, coptine (white, possibly identical with hydrastine), resin, ash 8 p. c. Masticatory; mouth wash for canker-sores, gargle for sore throat, ulcerated mouth. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Coptis* (diluted alcohol). *Tincture,* 10 p. c.; *Infusion, Decoction,* 5 p. c.

2. *Ado'nis verna'lis, Adonis, Pheasant's Eye, False Hellebore, N.F.*—The dried overground portion with not more than 5 p. c. of foreign organic matter; N. Europe, Asia, cultivated for ornament. Plant 15–50 Cm. (6–20′) high, leaves light green, pinnatifid; flowers yellow, stem glabrous, grooved, soft, weak, fruit, head of ovoid achenes; odor faint; taste bitterish, acrid. Powder, grayish-green—pith parenchyma, tracheæ, elliptical stomata, few or no starch grains and calcium oxalate crystals; contains aconitic acid, *adonidin* (adonin—consisting largely of aconitic acid) and picroadonidin which is a powerful heart poison, bitter, amorphous, soluble in water, alcohol, ether. Cardiac stimulant, diuretic, resembles digitalis, being more prompt and non-cumulative, but inferior to it—increases heart-force and arterial pressure; cardiac failure and dropsy, dyspnea, epilepsy. Dose, gr. 1–2 (.06–.13 Gm.); 1. *Fluidextractum Adonidis* (75 p. c. alcohol); Adonidin, gr. $\frac{1}{16}$–$\frac{1}{3}$ (.004–.02 Gm.).

3. *Helleb'orus ni'ger, Black Hellebore.*—The dried rhizome and roots, U.S.P. 1820–1870; C. and S. Europe, mountains. Acaulescent perennial, leaves evergreen, 7–9-lobed, flowers rose-like. Rhizome knotty, 5 Cm. (2′) long, 12 Mm. ($\frac{1}{2}$′) thick, blackish, bark thick, wood-wedges 8, medullary rays broad, taste sweet, bitter, usually from Germany;

contains helleborin, helleborein, helleboretin, resin, volatile oil, fixed oil, gum, etc. Heart stimulant, drastic hydragogue cathartic, alterative; used for melancholia, mania, dropsy, amenorrhea, epilepsy, skin troubles; in decoction, infusion, tincture, extract. Dose, gr. 5–20 (.3–1.3 Gm.).

4. *H. fœ'tidus, Bear's Foot.*—The leaves, U.S.P. 1820–1830; Europe. Perennial herb—the most energetic of the genus. Used for asthma, hysteria, hypochondriasis, tenia; in powder, decoction, syrup. Dose, gr. 5–20 (.3–1.3 Gm.). *H. vir'idis, Green Hellebore.* The rhizome (root), United States, Europe; rhizome about the same as *H. niger,* but has only 4 wood-wedges, and is smaller.

5. *Xanthorrhi'za apiifo'lia, Shrub Yellow-Root.*—The rhizome and roots, U.S.P. 1820–1870; S. and C. United States. Shrub .6–1 M. (2–3°) high, stem clustered, 6 Mm. ($\frac{1}{4}'$) thick, wood yellow, leaves compound, flowers April, purple, racemes, rhizome .6–1 M. (2–3°) long, 12 Mm. ($\frac{1}{2}'$) thick, yellowish internally and externally, bitter; contains berberine, resin, starch, gum, etc. Used as a tonic like calumba or quassia; in infusion, decoction, tincture. Dose, ʒss–1 (2–4 Gm.).

CIMICIFUGA. CIMICIFUGA, *U.S.P.*

Cimicifuga racemosa, (*Linné*) *Nuttall.*

The dried rhizome and roots with not more than 2 p. c. stems or other foreign organic matter, yielding not more than 4 p. c. acid-insoluble ash.

Habitat. United States, Canada; in shady, rocky places.

Syn. Cimicif., Black Cohosh, Black Snakeroot, Macrotys, Bugbane, Bugwort, Rattleroot, Rattleweed, Richweed, Squawroot, Rattlesnake's Root; Cimicifuga Rhizoma, Actæa Racemosæ Radix; Fr. Racine d'Actée a Grappes; Ger. Schwarze Schlangenwurzel.

Cim-i-cif'u-ga. L. *cimex,* bug, + *fugare,* to drive away—*i. e.,* from the fact of *Cimicifuga fœtida* being used for that purpose in Siberia and Kamtchatka.

Ra-ce-mo'sa. L. *racemosus*—*i. e.,* full of clusters, racemes—*i. e.,* the flowers.

Plant.—Perennial; stem slender, unbranched, 1.5–2.5 M. (5–8°) high; leaves irregularly ternately decompound, the rather small leaflets incised, 2.5–7.5 Cm. (1–3′) long; flowers June–July, regular, numerous, small, white, in wand-like racemes, 20–50 Cm. (8–20′) long, emit disagreeable odor. Rhizome, horizontal in growth, branched, 2–15 Cm. ($\frac{4}{5}$–6′) long, 1–2.5 Cm. ($\frac{2}{5}$–1′) thick, dark brown, grayish-black, slightly annulate from circular scars of bud scale-leaves; upper surface with numerous hard, erect, curved branches terminated by deep cup-shaped scars showing radiate structure; lower and lateral surfaces with numerous root-scars and few short roots; fracture horny; internally whitish and mealy or dark brown and waxy; bark thin, wood distinctly radiate and of same thickness as pith; odor slight; taste bitter, acrid; roots cylindrical, obtusely quadrangular, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}'$)

thick, 3–12 Cm. ($1\frac{1}{5}$–$4\frac{4}{5}$′) long, brownish, blackish, longitudinally wrinkled, fracture short; internally cortex thin, brownish, wood yellowish, 4–6-rayed. POWDER, light brown—numerous starch grains, .003–.015 Mm. ($\frac{1}{8325}$–$\frac{1}{1650}$′) broad, fragments showing tracheæ with

FIG. 119.—*Cimicifuga racemosa.*

bordered pores and lignified wood-fibers, fragments of suberized epidermis made up of tabular cells. *Solvents:* alcohol, boiling water. Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Rare: Caulophyllum, podophyllum, each sometimes 1 p. c., comfrey, possessing similar blackish color, smaller amount.

RANUNCULACEÆ

Commercial.—Plant, also named *Actæ'a racemosa*, emits when in bloom an odor resembling meadow-sweet, by many considered unpleasant. Rhizome should be collected in autumn (most active), and used shortly thereafter, as it deteriorates with age; recognized readily by the microscope from black and green hellebore whose rhizomes have few and broad wood-bundles and roots with pentagonal or hexagonal wood-zone; rhizome of *Actæa spica'ta*, Europe, very similar, but its juicy berries are in marked contrast with the official plant's dry follicles.

Constituents.—Cimicifugin, resins 3.5 p. c., amorphous resinous body (probably the active principle), racemosin, fat, starch, gum, tannin, volatile oil, sugar; ash 8–10 p. c.; latest investigators claim activity to depend upon: isoferulic acid, salicylic acid, palmitic acid, phytosterol, 3 crystalline bodies (alcohols ?), alkaloids (trace).

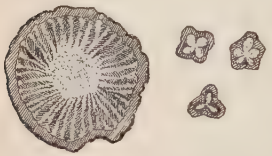


Fig. 120.—*Cimicifuga racemosa:* transverse section through a branch of the rhizome and through rootlets; natural size.

Cimicifugin.—Bitter, acrid crystalline principle, obtained by acting on the "Eclectic" resinoid, cimicifugin, or upon the fresh rhizome with alcohol, precipitating (resin, tannin, coloring matter) with lead subacetate, removing lead with hydrogen sulphide, and evaporating; it is soluble in alcohol, chloroform, slightly in ether.

Resins.—There are two of these, one soluble in alcohol but not in ether, the other soluble in ether as well as alcohol. These two are obtained as a mixture by exhausting powdered drug with alcohol, precipitating with water, drying precipitate, and as such constitutes the "Eclectic" *cimicifugin* (*macrotin*), a yellowish-brown hygroscopic powder. Dose, gr. ½–2 (.03–.13 Gm.).

Preparations.—1. *Fluidextractum Cimicifugæ.* Fluidextract of Cimicifuga. (Syn., Fldext. Cimicif., Fluid Extract of Cimicifuga, Fluidextract of Black Cohosh, Fluidextract of Black Snakeroot; Extractum Cimicifugæ Liquidum; Fr. Extrait fluide d'Actée a Grappes; Ger. Cimicifugafluidextakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126; menstruum: alcohol. Dose, ♏v–30 (.3–2 cc.).

Prep.: 1. *Elixir Sodii Salicylatis Compositum, N. F.*, 3.2 p. c.

2. *Tinctura Cimicifugæ, N.F.*, 20 p. c. (alcohol). Dose, ʒss–2 (2–4 cc.).

3. *Elixir Tongæ et Salicylatum, N. F.*, 3.5 p. c.

Unoff. Preps.: Decoction, 5 p. c., ʒss–1 (15–30 cc.). *Compound Syrup*, 4 p. c.

Properties.—Alterative (diuretic, diaphoretic, expectorant), antispasmodic, sedative (arterial and nervous), cardiac stimulant—safer than digitalis, emmenagogue. Acts on the gastric secretion like any other bitter, slightly depresses the rate, but increases the force of the pulse, like digitalis; contracts the uterus, increasing the menstrual flow and arterial tension.

Uses.—It was introduced first into medicine in 1831 by Dr. Young. Given as cardiac tonic in fatty heart, chorea, acute and chronic bronchitis, rheumatism, neuralgia, hysteria, phthisis, dyspepsia, amenorrhea, dysmenorrhea, seminal emissions. Large doses cause vertigo, tremors, reduced pulse, vomiting, prostration. Once, but not now, thought efficacious in snake bite, labor-pains, and ills of late pregnancy.

Incompatibles: Iron preparations, stimulants, alcohol, ammonia.

Synergists: Gold, digitalis, ergot, belladonna, etc.

Allied Plants:

1. *Delphin'ium Aja'cis, Delphinium, Larkspur Seed, N.F.*—The dried ripe seed with not more than 2 p. c. of foreign seeds or other foreign organic matter; S. Europe, cultivated as ornament, naturalized in United States. Plant, annual, hairy, bearing attractive flowers. Seed, irregularly tetrahedral, triangulate, 2 Mm. ($\frac{1}{12}'$) long and broad, blackish-brown, seed-coat crustaceous, endosperm whitish, fleshy, oily, embryo small; odor faint; taste bitter, then biting, acrid. Powder, gray-brown—endosperm parenchyma filled with fixed oil and aleurone grains, elongated cells from inner layer of seed-coat; contains alkaloids ajacine, ajaconine, (activity), fixed oil, volatile oil, resin, ash 7 p. c. Parasiticide, sedative, poisonous—similar to aconite and staphisagria; locally to destroy vermin, lice, itch-mite; rheumatism, neuralgia; rarely used internally. 1. *Tinctura Delphinii*, 10 p. c.

Fig. 121.—*Delphinium Consolida.*

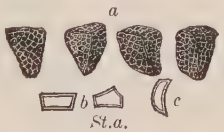


Fig. 122.—Stavesacre seed: *a*, natural size; *b*, cross-section; *c*, longitudinal section.

(alcohol). *D. Consol'ida, Field Larkspur*, U.S.P. 1820–1870, is a near related species with beautiful blue flowers, similar seed (tetrahedral, 1–2.5 Mm. ($\frac{1}{25}$–$\frac{1}{10}'$) broad, black, pitted), constituents, properties and uses. *D. urceola'tum (exalta'tum)*, Penn., Minn., and *D. carolinia'num (azu'reum)*, Wis., Ark. supply seeds having similar properties.

2. *D. Staphisag'ria, Staphisagria, Stavesacre*, Ripe seed, U.S.P. 1880–1910, Mediterranean Basin, cultivated. Annual herb, 1–1.3 M. (3–4°) high, branched, downy; root large, tapering; leaves 10–12.5 Cm. (4–5′) broad, palmately 5–9-parted, long, hairy petioles, flowers purplish, racemes; fruit 3-follicles, each 12-seeded, seed irregularly triangular, tetrahedral, flattened, dark brown, grayish, lighter with age, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{4}'$) long, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}'$) broad, coarsely reticulate; odor

slight, disagreeable; taste bitter, acrid. Powder, grayish-black—parenchyma and endosperm cells enclosing aleurone grains and fixed oil; solvents: alcohol, boiling water; contains alkaloids 1 p. c.: delphinine, delphinoidine, delphisine, staphisagrine, fixed oil, volatile oil, resin, ash 9 p. c. Parasiticide, sedative, irritant, poisonous; popular with Greeks, Romans, etc., but too dangerous for internal use—locally to kill vermin, lice, itchmite; rheumatism, neuralgia, earache, toothache. *Poisoning:* Symptoms and treatment similar to aconite and veratrum viride. Dose, gr. 1–2 (.06–.13 Gm.). *Fluidextract; Extract; Tincture,* 10 p. c., ♏v–15 (.3–1 cc.); *Ointment,* 20 p. c. Delphinine, gr. $\frac{1}{60}$–$\frac{1}{10}$ (.001–.006 Gm.).

ACONITUM. ACONITE, *U.S.P.*

Aconitum Napellus, *Linné.* { The dried tuberous root with not more than 5 p. c. of stems, nor 2 p. c. of other foreign organic matter.

Habitat. Europe, Asia, N. America, Himalaya, Alps, Pyrenees Mountains, 3,300–4,800 M. (11,000–16,000°) elevation; cultivated in England, C. Europe.

Syn. Aconit., Aconite Root, Monkshood, Wolfsbane, Cuckoo's or Friar's Cap, Friar's Cowl, Wolfroot, Styrian Monkshood, Mousebane, Face-in-hood, Jackob's-chariot, Blue-rocket; Br. Aconiti Radix; Fr. Aconit Napel, Coqueluchon; Ger. Tubera Aconiti, Eisenhutknollen, Sturmhut.

Ac-o-ni'tum. L. fr. Gr. *ἐν,* on, + *ἀκόναις,* rock—*i. e.,* it grows upon steep rocks in mountains; or fr. Fr. *Acone,* a town in Bithynia, where it grows plentifully.

Na-pel'lus. L. a little turnip; fr. *napus,* a turnip—*i. e.,* mediæval name from shape of roots, once used generically.

Plant.—Perennial herb; stem .6–1.5 M. (2–4°) high, round, smooth, leafy; leaves 5–10 Cm. (2–4′) broad, palmately 3–7 divided, dark green above, lighter below, smooth, shining, petiolate, divisions wedge-shaped, with 2–3 lobes extending midway; flowers July (third year), large, beautiful, violet-blue, on stem's summit, racemes, sepals petaloid, nectariferous; fruit, 3–5 pod-like capsules. Root, produced at the end of a short rhizome, conical, fusiform, 4–10 Cm. ($1\frac{3}{5}$–4′) long, 1–3.5 Cm. ($\frac{2}{5}$–$1\frac{2}{5}$′) thick at crown; grayish-brown, smooth or longitudinally wrinkled, upper end with a bud, remains of bud-scales or a stem-scar, other portions with many root-scars or short rootlets; fracture short, horny, mealy; internally, bark brownish, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, cambium zone 5–8-angled with a small fibro-vascular bundle in each angle; pith whitish, 2–7 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) broad; odor very slight; taste sweetish, acrid, soon developing tingling sensation, numbness. Powder grayish-brown—numerous, spherical (plano-convex) starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}$′) broad, tracheæ, stone cells tabular, irregular, fragments of cork (few) and parenchyma (many), stem bast-fibers (few, long). *Solvent:* alcohol. Dose, gr. 1–2 (.06–.13 Gm.).

Adulterations.—Allied aconite roots (*A. variegatum*—much smaller, *A. Fischeri*—light gray, plump, smooth), defective roots,

small horse-radish roots (collected only when leaves absent, as by these they may easily be distinguished), yellowish externally, taste exceedingly pungent irritating; roots of European Masterwort (*Imperato'ria* (*Peuced'anum*) *Ostru'thium*), which closely resemble aconite root, but are aromatic, pungent, with oil-cells arranged in several circles, easily visible in cross-sections.

Commercial.—Plant grows wild, but under cultivation becomes slightly stronger, owing to which the Br. P. recognizes alone its root collected in autumn; all parts are very poisonous, a fact even known to the ancients, and was not introduced into medicine until 1762 (Baron Störck, Vienna); it is grown in gardens for ornamental flowers and when these have expanded, thereby insuring identity, the root should be collected. Imported mostly from Germany (England, France, Switzerland, India) in packages, bales, etc.

FIG. 123.—*Aconitum Napellus: a*, transverse section of tuber, *b*, fruit carpels; *c*, flowering branch; *d*, flower deprived of calyx, showing the only 2 peculiarly shaped petals, the 6 others almost aborted; *e*, tuber.

CONSTITUENTS.—Four alkaloids (one crystalline, three amorphous) .24–.62–1.15 p. c.: Aconitine (crystalline), Picraconitine (benzaconine, isaconitine), $C_{25}H_{39}O_{11}N$, Aconine, Pseudaconitine (napelline), $C_{33}H_{45}O_{12}N$, aconitic acid, $H_3C_6O_6H_3$, starch, resin, fat, sugar, mannite.

Aconitina, Aconitine, $C_{34}H_{47}O_{11}N$, *U.S.P.*—(Syn., Aconitin., Napaconitine, Aconitia; Fr. Aconitine; Ger. Aconitin.) Exists in combination with aconitic acid, and is obtained by exhausting root with cold rectified fusel oil, shaking resulting tincture with diluted (1 p. c.) sulphuric acid, adding chloroform to remove resin, rendering alkaline with sodium carbonate, shaking out with ether. It is in colorless or

white crystals, odorless, permanent, producing tingling and numbing sensation to tongue, lips—taste cautiously even when diluted; soluble in alcohol (28), ether (65), benzene (7), slightly in water, almost insoluble in petroleum benzin; solutions alkaline; melts at 195° C (383° F.); forms salts, as hydrochloride, nitrate, sulphate, etc.; commercial aconitine occurs in amorphous and crystalline forms, but the latter should alone be used, as the former contains derivatives lessening its activity 10–15 p. c. *Tests:* 1. Dissolve .001 Gm. with 2–3 drops of nitric or sulphuric acid on white porcelain surface—colorless solution; with 2 drops of sulphuric acid containing .005 Gm. of ammonium vanadate in each cc.—orange solution. 2. Dilute solutions, + mercuric potassium iodide T. S., or + tannic acid T. S., or + gold chloride T. S.—precipitate; concentrated solutions, + platinic chloride T. S., or + mercuric chloride T. S., or + trinitrophenol (picric acid) T. S.—precipitate; incinerate—ash negligible. 3. Evaporate a solution of 0.1 Gm. with 5 drops of fuming nitric acid, cool, resulting yellow residue, + alcoholic potassium hydroxide T. S.—not violet (abs. of pseudaconitine, atropine). Should be kept dark in well-closed containers. Dose (crystals), gr. $\frac{1}{640}$–$\frac{1}{200}$ (.0001–.00035 Gm.; (amorphous), gr. $\frac{1}{64}$–$\frac{1}{20}$ (.001–.003 Gm.).

Aconine, $C_{26}H_{41}O_{11}$.—This appears antagonistic to aconitine in cardiac effect; picraconitine is considered inert; aconitic acid is abundant, but is chiefly in combination with calcium, and is almost inert.

PREPARATIONS.—1. *Tinctura Aconiti.* Tincture of Aconite. (Syn., Tr. Aconit.; Fr. Teinture de Racine d'Aconit; Ger. Akonittinktur, Eisenhuttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; use menstruum: 70 p. c. alcohol, and adjust to assay (biological). Dose, ♏ss–10 (.03–.6 cc.).

Preps.: 1. *Dentilinimentum Aconiti Compositum, N.F.*, 80 p. c.
2. *Dentilinimentum Aconiti et Iodi Compositum, N.F.*, 85 p. c.

2. *Fluidextractum Aconiti, N.F.* (75 p. c. alcohol). Dose, ♏ss–2 (.03–.13 cc.): Prep.: 1. *Linimentum Aconiti et Chloroformi, N.F.*, fldext. 4.5 p. c., alcohol 8, chloroform 12.5, soap liniment 75.

Unoff. Preps.: Abstract (alcohol), gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Extract* (alcohol), gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.). *Fleming's Tincture Aconite Root,* 70 p. c. (alcohol), ♏ss–4 (.03–.26 cc.). *Linimentum Aconiti* (Br.), 50 Gm. + camphor 3 Gm., alcohol q. s. 100 cc. *Oleate of Aconitine*, 2 p. c. *Tincture Aconite Leaves*, 8 p. c. (diluted alcohol), ♏j–6 (.06–.4 cc.). *Unguentum Aconitinæ* (Br.), 2 p. c. *Glycerite. Plaster.* Pseudaconitine (*A. ferox*), gr. $\frac{1}{250}$–$\frac{1}{100}$ (.00026–.00065 Gm.).

PROPERTIES.—Sedative (heart and nerve), anodyne, diaphoretic, antipyretic, myotic, poisonous. Produces tingling and numbness of the lips, mouth, and fingers; increases the secretion of the kidneys, salivary glands, and skin; circulation (heart action, pulse) becomes weak and slow, due to direct depression of heart-muscle, and stimula-

tion of vagus (pneumogastric) nerve; respiration (breathing) shallow and slow; arterial pressure is decreased; temperature is lowered, all causing a tendency to fainting when in the erect position, and giving rise to its popular name "therapeutic lancet;" it increases urinary flow; effect lasts about 3 hours—paralyzes first the sensory and then the motor nerves.

Uses.—It should never be given in asthenic or debilitated conditions, or when the heart action is weak, or in gastric catarrh, but may be employed in all sthenic or inflammatory fevers of the young and vigorous; croup, laryngitis, pharyngitis, tonsillitis, acute meningitis, peritonitis, pleuritis, rheumatism; measles, scarlet fever, erysipelas, first stage of pneumonia, pericarditis and pleurisy, nervous heart palpitation, cardiac hypertrophy, epistaxis, vomiting of pregnancy. Locally on non-abraded surfaces; neuralgia, rheumatism, sciatica, herpes zoster, chilblains, pruritus, odontalgia, periodontitis, inflamed pulps.

Poisoning: Have anxious countenance, pallid, clammy skin covered with cold sweat; pulse and respiration slow, weak, and irregular; muscular weakness, loss of sight and hearing, pupils either normal, contracted or dilated, general anesthesia, collapse, death from syncope, or respiratory paralysis, sometimes preceded by convulsions; conscious until near the end, when carbon dioxide narcosis sets in. Evacuate stomach reclining, direct recumbent position, feet elevated, warmth to extremities, give diffusible cardiac stimulants (brandy, whisky, alcohol, ether, ammonia) by the stomach, rectum, or skin, then digitalis, tannin; artificial heat and respiration (rhythmically raising and lowering arms from straight at sides to up over head and back again 20 times per minute), amyl nitrite, atropine, and strychnine (hypodermically) to stimulate heart and respiration.

Fig. 124.—*Aconitum Napellus:* leaf, small sized.

Incompatibles: Ammonia, alcohol, alkalies, atropine, digitalis, ether, morphine, heat, turpentine.

Synergists: Veratrum viride, pulsatilla, staphisagria, cold, fatigue.

Leaves, U.S.P. 1820–1870. These are considered 5–20 times weaker than the root, yet many specimens yield considerable alkaloids; their uncertainty and deception have led to disuse; but if collected when flowers are two-thirds in bloom they are reliable; it is then that all nutrient constituents are in demand for the perfection of reproductive organs, thus leaving behind in the leaves a goodly quantity of the (waste products) alkaloids. Dose, gr. 1–4 (.06–.26 Gm.).

RANUNCULACEÆ

Allied Plants:

1. *Aconitum neomonta'num.*—Leaves, U.S.P. 1820–1830, and *A. panicula'tum*, leaves, U.S.P. 1840, possess very little acridity, but even now their roots are collected and mixed with the official.

2. *A. Cam'marum* (*variega'tum*).—Europe; root globular, ovate, 12 Mm. ($\frac{1}{2}'$) long, pith rays 5, short, rounded; and *A. Störckia'num*, Europe; root conical, slender, pith roundish pentagonal, similar in effect, smaller than, but often found mixed with the official.

3. *A. fer'ox.*—India aconite (native Bikh or Bish) is the strongest species, with root 5–10 Cm. (2–4′) long, 2.5 Cm. (1′) thick, conical and brown; yields pseudaconitine (peraconitine), similar to and as active as aconitine; *A. uncina'tum* and *A. lu'ridum* roots are collected with this, as they all have constituents similar to the official, but here pseudaconitine predominates.

4. *A. Fisch'eri* and *A. japon'icum*, *Japanese* and *Chinese Aconite.*—Roots napiform, long, pith circular, 5–7-rayed; yields japaconitine, identical with aconitine; allied to former is *A. columbia'num;* Rocky Mountains; poisonous. *A. heterophyl'lum*, India—fusiform, conical, bitter, not acrid or poisonous, *A. Antho'ra*, Europe—fusiform, long, pith thin, rays short and long, and *A. Lycoc'tonum*, Europe, N. Asia—rhizome oblique, several-headed, bitter.

5. *Pulsatil'la* (*Anem'one*) *vulgar'is*, *P. praten'sis*, or *P. pa'tens*, *Pulsatilla*, *Pasque Flower*, *N. F.*—The dried herb with not more than 5 p. c. of foreign organic matter; Europe (England, Siberia). Perennial herbs, 10–25 Cm. (4–10′) high, covered with soft, silky hairs. Leaves and flowering scapes matted, silky-villous, petioles hollow often purplish, blades pinnately cleft, flowering scape up to 30 Cm. (12′) in length, solid below, hollow above, flowers purplish, terminal, bell-shaped, 6 sepals, fruit achene, plumose-tailed; nearly odorless; taste acrid. Powder, brownish—thick-walled hairs, tracheæ, stomata, epidermal cells with wavy vertical walls, calcium oxalate crystals and starch grains few or absent; contains anemonin (activity—volatile, causing drug to be inert after 1 year), acrid anemone camphor, volatile oil, iso-anemonic acid, $C_{15}H_{14}O_7$, ash 10 p. c. Sedative, anodyne, mydriatic, diuretic, diaphoretic, emmenagogue, expectorant, vesicant, emetic, poisonous—similar to aconite, causing tingling, numbness, reducing respiration, temperature, cardiac and arterial tension, paralysis of motion and sensation; dysmenorrhea, bronchitis, asthma, whooping-cough, gastritis, epididymitis, orchitis, conjunctivitis, eczema, ulcers, meningitis. *Poisoning:* Symptoms and treatment similar to aconite. Dose, gr. 1–5 (.06–.3 Gm.); 1. *Tinctura Pulsatillæ*, 10 p. c. (75 p. c. alcohol), dose, ♏xv–30 (1–2 cc.). *Extract* (expressed juice + alcohol), gr. $\frac{1}{2}$–3 (.03–.2 Gm.); Homeopathic tincture (extract); anemonin, gr. $\frac{1}{4}$–$\frac{3}{4}$ (.016–.05 Gm.). *P. hirsutis'sima* (*Anemone pa'tens* var. *Nuttallia'na*): herb, U.S.P. 1880, W. N. America, flowers whitish, purplish, sepals 5–7,—2.5–4 Cm. (1–$1\frac{3}{5}'$) long, developed before the leaves; *A. quinquefo'lia* (*nemoro'sa*), *Wood Flower*, *Wood Anemone*, N. America;

flowers purplish-white, *A. corona'ria*, *A. sylves'tris*, and *A. ranunculoi'des*, Levant, Asia, Europe, are all acrid and deteriorate upon drying.

6. *Hepat'ica Hepatica* (*tri'loba*), *Noble Liverwort.*—The leaves, U.S.P. 1830–1870, N. America, Europe. One of our earliest harbingers of

FIG. 125.—*Pulsatilla* (*Anemone*) *Pulsatilla.*

FIG. 126.—*Pulsatilla* (*Anemone*) *pratensis.*

spring; acaulescent perennial, flowers, April, bluish, leaves reniform, 5 Cm. (2′) long, 3-lobed; contains mucilage, tannin. Tonic, demulcent, deobstruent; liver affections, bronchitis, phthisis; in decoction, infusion. Dose, ʒss–2 (2–8 Gm.).

FIG. 127.—*Hepatica Hepatica* (*triloba*): leaf showing venation.

FIG. 128.—Ranunculus in bloom.

7. *Ranun'culus bulbo'sus, Bulbous Buttercup.*—The corm and herb, U.S.P. 1820–1870, Europe, N. America. Plant hairy, 15–45 Cm. (6–18′) high, bulb at stem base, flowers May, yellow, 5's; contains volatile

oil (anemonin + anemonic acid). Irritant, diuretic, narcotic; externally —bronchitis, rheumatism, sciatica; in decoction, infusion. Dose, ʒss–1 (2–4 Gm.).

23. BERBERIDACEÆ. Barberry Family.

Ber-be-ri-da′se-e. L. *Berber(is)id* + aceæ, fr. *Berberys—i. e.*, Arabic name of the fruit. Shrubs, herbs with watery juice. Distinguished by few stamens (same number as petals and opposite them) in 2–3 whorls, anthers opening by 2-hinged valves (Podophyllum, longitudinal, as in Ranunculaceæ); leaves usually with spiny teeth, sometimes reduced to spines or barbs, hence the name *barberry;* sepals and petals in 2 rows, 3 each, imbricate; ovary 1-celled, superior; temperate climates, tropics; cathartic, astringent, bitter, acrid (oxalic), yellow dye.

Genus: **1. Podophyllum.**

PODOPHYLLUM. PODOPHYLLUM, *U.S.P.*

Podophyllum peltatum, *Linné.* { The dried rhizome and roots with not less than 3 p. c. of resin.

Habitat. N. America (Canada, United States) in rich woods, thickets.

Syn. Podoph., Mandrake, May Apple Rhizome, American (Wild) Mandrake, Ground (Wild) Lemon, Hog (Indian, Devil's) Apple, Duck's Foot, Umbrella Plant, Vegetable Mercury (Calomel); Br. Podophylli Rhizoma; Fr. Rhizome de Podophyllum; Ger. Fussblattwurzel.

Pod-o-phyl′lum. L. fr. Gr. *ποδός*, foot, + *φύλλον*, leaf—*i. e.*, its 5-7-parted leaf resembles the foot of aquatic birds or domestic fowls, as ducks, etc.

Pel-ta′tum. L. *peltatus,* having a pelta or light shield—*i. e.*, petioles attached to the middle of the lamina instead of to the margin.

May apple—i. e., plant blooms in May, thus starting the fruit, which ripens in summer (August).

Plant.—Perennial herb; stem .3 M. (1°) high, pale green, divides near the summit into 2 petioles, each bearing a palmately 5–7-deeply-lobed, peltate leaf 10–15 Cm. (4–6′) wide, segments wedge-shaped, coarsely toothed at their ends, glaucous-green, petioles 7.5 Cm. (3′) long; flowers May, borne at fork of petioles, single, nodding, white 5 Cm. (2′) broad, 6–9 petals, 12–18 stamens; fruit yellowish berry, 2.5–5 Cm. (1–2′) long, ovoid, fleshy, soft, indehiscent; seed about 12; often eaten by animals, hence some of its names. Rhizome, of horizontal growth, creeping, subcylindrical, jointed, compressed on upper and lower surfaces, sometimes branched, 3–20 Cm. ($1\frac{1}{5}$–8′) long, internodes 2–9 Mm. ($\frac{1}{12}$–$\frac{1}{3}$′) thick, nodes annulate, 12 Mm. ($\frac{1}{2}$′) thick, dark brown, longitudinally wrinkled or nearly smooth with irregular, somewhat V-shaped scars of scale leaves, upper surface of nodes marked with large, circular, depressed stem-scars, sometimes with buds or stem-bases, lower surface of nodes with numerous root-scars or roots, 2–7 Cm. ($\frac{4}{5}$–3′) long, 2 Mm. ($\frac{1}{12}$′) thick, fracture short;

internally, cork light brown, wood with yellowish vascular bundles, pith large, white; odor slight; taste disagreeably bitter, acrid. POWDER,

FIG. 129.—*Podophyllum peltatum.*

yellowish-brown—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}'$) broad, few rosette aggregates of calcium oxalate, tracheæ, parenchyma,

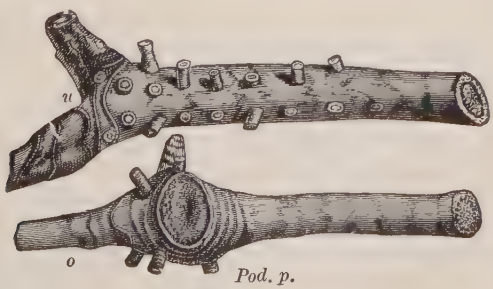


FIG. 130.—Podophyllum: *u*, under side; *o*, upper side.

cork cells; odor pronounced, characteristic. *Solvents:* alcohol; boiling water partially. Dose, gr. 5–15 (.3–1 Gm.).

Adulterations.—Sanguinaria (due to similarity of leaves despite greater value) 2–3 p. c., geranium 2–3 p. c., comfrey 1 p. c.

Commercial.—Plants of 100 or more grow in rounded or irregular-shaped clusters (patches), 3–6 M. (10–20°) broad, near wood-borders, fence-panels, or in the open, preferably on heavy soil; rhizome and roots should be collected soon after the leaves fall off, Aug.-Sept., those containing much resin being surprisingly heavy considering their appearance, breaking with an elastic, short, noisy fracture; drug often recognized in the trade as *thick*, *thin*, *heavy*, *light*, referring chiefly to physical characteristics. That collected in autumn, after flowering and fruiting, is preferred, being heavier from abundant resin content (podophyllotoxin) and breaking with a cleaner fracture.

Constituents.—Resin 4–5 p. c. (varying little in quantity but greatly in content (podophyllotoxin) according to season and time of collection), starch, gum, fixed oil, gallic acid, ash 2–3 p. c.

Resin (Resina Podophylli, Podophyllin), *U.S.P.*—This is a complex substance consisting of: (1) *podophyllotoxin*, $C_{15}H_{14}O_6$, 20–26 p. c. which is obtained after removing the fat with benzin, by precipitating the podophyllinic acid from a chloroformic solution of the resin or rhizome, by the addition of ether and then simply evaporating the ethereal solution; this is the cathartic principle, being whitish, bitter, resinous, crystallizable, soluble in chloroform, ether, acetone, alcohol; cherry-red, then greenish-blue and violet by sulphuric acid, when heated with alkalies is converted by hydration into podophyllic acid, $C_{15}H_{16}O_7$, which readily loses water, forming crystalline picropodophyllin (inactive, isomeric with podophyllotoxin); (2) *podophyllinic acid*, which is an inactive resin-acid, insoluble in ether, but soluble in chloroform or alcohol, and obtained by the above process for podophyllotoxin (being precipitated and left behind upon the addition of ether). The color is due to *podophylloquercetin*, which occurs in yellow needles, insoluble in water, slightly in chloroform, more so in ether, freely in alcohol. The small amount of uncrystallizable resin, *podophylloresin*, is also purgative.

Preparations.—1. *Resina Podophylli.* Resin of Podophyllum. (Syn., Res. Podoph., Podophyllin; Fr. Résine de Podophylle; Ger. Podophyllinum, Podophyllin, Podophyllumharz.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until percolate when dropped into water produces only slight turbidity, reclaim alcohol until percolate the consistence of thin syrup, and pour this slowly, stirring constantly, into 100 cc. of water mixed with hydrochloric acid 1 cc., cool, let precipitate subside, decant supernatant liquid, wash precipitate twice by decantation, each time with cold water 100 cc., dry on strainer in a cool place exposed to air and protected from light, and if it should coalesce into lumps with a glossy surface reduce to powder in a mortar. It is an amorphous powder, light brown, greenish-yellow, darker on exposure to heat or light, slight peculiar odor, faintly bitter taste; very irritating to mucous

membrane, especially that of the eye; soluble in alcohol with only slight opalescence; alcoholic solution faintly acid; 75 p. c. soluble in ether; 65 p. c. soluble in chloroform. *Tests:* 1. Hot aqueous solution on cooling—deposits most of its contents; filtrate bitter, with a few drops of ferric chloride T. S.—brown. 2. Dissolve in potassium or sodium hydroxide T. S.—deep yellow liquid, becoming darker on standing, from which resin is reprecipitated by acids. 3. Add .4 Gm. to 3 cc. of 60 p. c. alcohol, + .5 cc. potassium hydroxide T. S., shake—does not gelatinize (dif. from resin in *P. Emodi*); ash 1.5 p. c. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–1 (.008–.06 Gm.).

Preps.: 1. *Pilulæ Aloes et Podophylli Compositæ, N.F.*, $\frac{1}{2}$ gr. 2. *Pilulæ Aloes, Hydrargyri et Podophylli, N.F.*, $\frac{1}{4}$ gr. 3. *Pilulæ Aloini Compositæ, N.F.*, $\frac{1}{8}$ gr. 4. *Pilulæ Cathartice Vegetabiles, N.F.*, $\frac{1}{4}$ gr.

Unoff. Preps.: Fluidextract (alcohol), dose, ♏v–30 (.3–2 cc.). *Abstract* (alcohol), dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.). *Extract* (80 p. c. alcohol), dose, gr. 5–10 (.3–.6 Gm.). *Tincture* (Br.), 3.65 p. c. of resin in alcohol, dose, ♏v–15 (.3–1 cc.). *Podophyllotoxin* (pure), dose, gr. $\frac{1}{12}$–$\frac{1}{8}$ (.005–.008 Gm.).

Properties.—Hydragogue cathartic, cholagogue, alterative, irritant, tonic—slowest acting official purgative. Increases intestinal secretion, bile-flow, causes copious watery stools, griping, nausea in from 10–20 hours, acts mainly on the duodenum, but is a powerful intestinal irritant, resembling jalap and calomel, only slower; large doses are distinctly poisonous, producing in the young vomiting, purging, collapse, coma, finally epileptiform convulsions. Those employed in powdering the drug have irritation of the eyes, nose, mouth, respiratory passages, and skin. The resin applied to ulcers produces purgation and is also a powerful irritant to the skin. Its action upon the liver, being somewhat similar to that of mercury, led some early to claim for it alterative properties equal to those of that metal, and for a time it was employed under the name of "vegetable calomel" in those diseases for which mercury is a recognized specific, but now it is believed to have incidentally only very slight alterative power, and to possess no property in common with mercury save that of catharsis.

Uses.—Constipation, torpid liver, lead costiveness, diarrhea, catarrhal or malarial jaundice, remittent fevers, dyspepsia, bilious vomiting, and headache. With cream of tartar useful in dropsies, rheumatic, scrofulous, and syphilitic affections; should be associated with hyoscyamus or belladonna to overcome griping, and, owing to extremely slow action, should not be given in combination with brisk cathartics, but preferably with such as act in approximately the same time, as calomel, jalap, aloe, leptandra, etc.—gr. 5 (.3 Gm.) of podophyllin (resin) have killed, so have ℥iss (6 Gm.), but in one case gr. 10 (.6 Gm.) failed to produce more than abdominal pains.

BERBERIDACEÆ

Allied Plants:

1. *Podophyllum Emo'di, Podophylli Indici Rhizoma* (Br.)—India, Hazara, Kashmir; Himalaya Mountains; rhizome, collected after flowering, cylindrical, stem-scars crowded on upper surface, many roots beneath; yields resin (Podophylli Indici Resina—Br.) 10–14 p. c., which contains podophyllotoxin 38–63 p. c., thereby making it similar to but stronger than our official drug. Dose of resin, gr. $\frac{1}{8}$–1 (.008–.06 Gm.).

2. *Caulophyl'lum thalictroi'des, Caulophyllum, Blue Cohosh, Papoose (Squaw) Root, N.F.*—The dried rhizome and roots with not more than 3 p. c. of foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; N. America (Canada, United States). Smooth, glaucous perennial, .6 M. (2°) high, with large triternately compound leaf at summit, leaflets 3–5-lobed; flowers greenish-yellow. Rhizome horizontal, 7–25 Cm. (3–10′) long, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) thick, large cup-shaped stem-scars above, curved, tortuous, thin, tough, tangled or matted roots below often concealing rhizome, yellowish-gray; fracture tough, woody; odorless, sternutatory; taste bittersweet, acrid. Powder, light brown—numerous starch grains, fragments of cork, tracheæ, wood-fibers, tracheids, parenchyma; contains caulophylline, caulophyllin (resins) 12 p. c., leontin (saponin-like glucoside—active principle). Antispasmodic, diuretic, emmenagogue, demulcent, sternutatory, sedative, oxytocic; hysteria, amenorrhea, spasmodic dysmenorrhea, uterine subinvolution (causing muscular contraction), arrests or produces abortion; the aborigines believed the infusion their best parturient, drinking it for several weeks prior to labor. Dose, gr. 10–30 (.6–2 Gm.); 1. *Fluidextractum Caulophylli* (75 p. c. alcohol): Preps.: 1. *Elixir Aletridis Compositum* (fldext. 6.55 p. c.); 2. *Elixir Heloniadis Compositum* (fldext. 3.2 p. c.). *Extract*, gr. 2–5 (.13–.3 Gm.), *Tincture*, 25 p. c., ʒj–2 (4–8 cc.); decoction, infusion, each 5 p. c., ℥j–2 (30–60 cc.).

Fig. 131.—*Berberis vulgaris (canadensis).*

3. *Ber'beris Aquifo'lium, Berberis, Oregon Grape Fruit, N.F.*—The dried rhizome and roots with not more than 5 p. c. of overground parts or other foreign organic matter—rejecting pieces over 45 Mm. ($1\frac{4}{5}$′) thick, or with bark removed; United States, Oregon, California, mountains. Tall shrub, 1.5–2 M. (5–6°) high; leaves coriaceous, evergreen, shining, flowers small, numerous, yellowish-green; fruit purple berry with acid pulp. Rhizome cylindrical, knotty, branched,

cut into pieces of varying length, up to 45 Mm. ($1\frac{4}{5}'$) in thickness, splitting on drying, yellowish-brown, wrinkled; fracture hard, tough; bark 1 Mm. ($\frac{1}{25}'$) thick, separable into layers, wood yellow, radiate, pith small, sometimes excentric, odor slight; taste distinctive, bitter, on chewing—saliva yellow. Powder, yellowish-brown—medullary rays, wood-fibers, few tracheæ, starch grains; solvent: diluted alcohol; contains (bark) berberine 2.35 p. c., oxyacanthine 2.82 p. c., resin, tannin, phytosterin. Alterative, diuretic, antiperiodic, tonic, laxative; scrofulous and syphilitic cachexia, chronic eczema, psoriasis, uterine diseases, dyspepsia with constipation. Dose, gr. 10–30 (.6–2 Gm.); 1. *Fluidextractum Berberidis* (diluted alcohol), dose, ♏x–30 (.6–2 cc.); 2. *Fluidextractum Trifolii Compositum*, 10.8 p. c.

4. *B. vulga'ris (canaden'sis)*.—The fruit, U.S.P. 1830; the bark of the root, 1860–1870. Spreading shrub, 1–2 M. (3–6°) high, thorny branches, bark gray, wood yellow, leaves toothed, spiny; flowers, yellow racemes; fruit, oval, scarlet berry; root-bark yellowish-gray, separable into laminæ, bitter, astringent; contains berberine, resin, tannin, fat. Used in febrile diseases, diarrhea; bark in dysentery, dropsy, dyspepsia, to lessen size of spleen; similar to calumba. Dose (bark), gr. 2–10 (.13–.6 Gm.); infusion, decoction; fruit juice sometimes made into syrup, preserves, etc.

24. MENISPERMACEÆ. Moonseed Family.

Men-i-sper-ma'se-e. L. *Menisperm-um* + aceæ, fr. Gr. *μήνη*, the moon, + *σπέρμα*, a seed—*i. e.*, fruit (seed) kidney- or crescent-shaped. Shrubs, woody climbers, herbaceous vines; leaves exstipulate, alternate; flowers diœcious; sepals 4–12; petals 6, similar, usually in 2 rows, imbricate; stamens mostly 6; fruit drupe, superior; species very heteromorphous; embryo horseshoe-shape; albumin scanty; tropics; bitter, narcotic, tonic, poisonous.

Genus: **1. Jateorhiza.**

CALUMBA. CALUMBA, *U.S.P.*

Jateorhiza palmata, (*Lamarck*) *Miers.* { The dried root yielding not more than 2.5 p. c. of acid-insoluble ash.

Habitat. E. Africa, Madagascar (Mozambique and Quilimane forests, along the lower Zambesi River); cultivated in Africa and E. India islands.

Syn. Calumb., Columba, Columbo, (Foreign) Colombo, Kalumb.; Br. Calumbæ Radix; Fr. Colombo, Racine de Colombo (Calumbé); Ger. Radix Colombo, Kolombowurzel.

Jat-e-o-rhi'za. L. fr. Gr. *ἰατήρ(ωος)*, healing, + *ῥίζα*, a root—*i. e.*, its medicinal virtues.

Pal-ma'ta. L. *palmatus*, like the palm of the open hand with radiating fingers (segments)—*i. e.*, the leaves palmately-lobed or divided.

Ca-lum'ba. L. fr. native African name, *kalumb*, hence Colombo in Ceylon, supposed to be the plant's original habitat.

MENISPERMACEÆ

PLANT.—Perennial climber; stems several, green, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) thick, hairy, from short, thick, irregular rhizome; leaves petiolate, large, 25 Cm. (10′) long, 35 Cm. (14′) broad, orbicular, cordate, 3–5–7-palmately-lobed, lobes entire, wavy, hairy; flowers diœcious, 6's, 12 Mm. ($\frac{1}{2}$′) broad; fruit 3 ovoid fleshy drupes, size of hazelnut, 1-seeded. ROOTS, from rhizome, many, fleshy, fasciculated, fusiform; commercially in circular, oval disks up to 10 Cm. (4′) and seldom exceeding 2 Cm. ($\frac{4}{5}$′) thick, or longitudinal, oblique slices up to 30 Cm. (12′) long; edge brown, roughly wrinkled, cut surfaces yellowish-brown, grayish-yellow, transverse slices radiate in outer portion with dark cambium, center often depressed (thinnest); fracture short, mealy; odor slight; taste slightly aromatic, very bitter. POWDER,

FIG. 132.—*Jateorhiza palmata* (*calumba*).

greenish-brown, grayish-yellow—many starch grains, .003–.085 Mm. ($\frac{1}{8325}$–$\frac{1}{300}$′) broad, few stone cells with one or more calcium oxalate prisms or sphenoidal microcrystals; few fragments with tracheæ associated with wood-fibers. *Solvents:* alcohol (75 p. c.); boiling water largely (calumbin, berberine). Dose, gr. 5–30 (.3–2 Gm.).

ADULTERATIONS.—Roots of *Bryonia alba* and *Frasera carolinensis* (*Walteri*)—American Columbo. These sometimes are dyed yellow with turmeric or safflower, and made bitter with infusion of calumba or quassia, thus giving a near resemblance, but recognized by the lighter or slightly false color, absence of dark cambium zone, radiating lines, etc.; the latter also precipitates with iron salts, is not mucilaginous nor affected by infusion of galls, reddens litmus, evolves ammonia with fixed alkalies, and contains no starch. Occasionally with slices of the

stem of *Coscin'ium fenestra'tum*, Ceylon, which are harder, smoother, and not contracted centrally; false calumba—center elevated, not depressed.

Commercial.—Plant, also named *Menispermum palmatum*, *Coc'culus palma'tus*, and natively called *Kalumb*, resembles very closely our *Menispermum canadense*, reaching the top of lofty forest trees from the seacoast to many miles inland. Roots of wild plants are dug in hot dry season (March), tubercles separated, washed, cut into transverse and longitudinal slices, and dried slowly in the shade; often more or less worm-eaten. Portuguese always have controlled (1508) its trade, exporting it for 3 centuries via Colombo, Ceylon, also their possession, to veil its origin; now enters market from Zanzibar, or via Bombay.

FIG. 133.—Calumba: transverse section, natural size; *r*, bark; *k*, cambium; *h*, wood; *m*, pith (medulla).

CONSTITUENTS—Calumbin .8 p. c., Berberine 1 p. c., Calumbic acid, calumbine (?), starch 35 p. c., pectin 17 p. c., gum 4.7 p. c., resin 5 p. c., wax, calcium oxalate, ash 6–8 p. c.

Calumbin, $C_{21}H_{24}O_7$.—Gives most of the bitterness—obtained by exhausting root or alcoholic extract with alcohol or ether, evaporating and letting stand several days for crystals to form, which are white, bitter, odorless, soluble in alcohol, ether, chloroform, alkalies, acetic acid, almost insoluble in water. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

Berberine, $C_{20}H_{17}O_4N$.—This is left in mother-liquor from calumbin, which is evaporated to dryness, exhausted with boiling alcohol, evaporated, allowed to crystallize upon standing. Recently this content has been resolved into three alkaloids—palmatine, calumbamine, jateorhizine—which with calumbin constitute the drug's activity. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.).

Calumbic Acid, $C_{21}H_{22}O_6.H_2O$.—Obtained from 3 p. c. oxalic acid infusion by adding barium hydroxide and treating precipitate with alcohol; it is less bitter than calumbin, amorphous, straw-yellow, soluble in alcohol, alkalies, almost insoluble in water or ether, and is in combination with berberine—the two believed to be derived from calumbin, this latter being the anhydride of calumbic acid.

Calumba contains no tannin, hence can well be used with iron salts and alkalies as a substitute for gentian, etc.; its infusion or tincture, however, precipitates with infusion of galls or solution of lead acetate.

PREPARATIONS.—1. *Tinctura Calumbæ.* Tincture of Calumba (Syn., Tr. Calumb., Tinctura Colombo; Fr. Teinture de Colombo; Ger. Kolombotinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104—packing moderately; menstruum: 60 p. c. alcohol. Dose ʒss–2 (2–8 cc.). 2. *Fluidextractum Calumbæ, N.F.* (67 p. c. alcohol). Dose,

MENISPERMACEÆ

♏v–30 (.3–2 cc.). *Extract*, gr. 1–5 (.06–.3 Gm.). *Infusion*, 5 p. c., ℥ss–1 (15–30 cc.).

Properties.—Tonic, stomachic, stimulant, increases appetite and digestion by stimulating the gustatory nerves, thereby dilating the gastric vessels and augmenting secretion, does not constipate; externally—antiseptic, disinfectant, anthelmintic.

Uses.—Dyspepsia, debility, remittent fevers, dysentery, diarrhea, cholera morbus, cholera infantum, hectic fever of phthisis, vomiting of pregnancy, bowel flatus, purging; large doses emeto-cathartic.

Allied Plants:

1. *Jateorhiza Calumba.*—About the same as the official, possibly having a variety difference in that the basal lobes of leaves are rounded but do not overlap, and male inflorescence is hispid. In the official variety, basal lobes mostly overlap, and male inflorescence is smooth. Our commercial root is collected indiscriminately from both species.

2. *Anamir'ta Coc'culus, Cocculus* (*Indicus*), *Fish* (*Indian*) *Berry, N.F.*—The dried ripe fruit with 2 p. c. foreign organic matter; E. India, Ceylon. Large woody climber; leaves 10–20 Cm. (4–8′) long, cordate; flowers, small, diœcious. Fruit (in clusters 2–5) drupe, reniform, 8–13.5 Mm. ($\frac{1}{3}$–$\frac{7}{12}$′) long, 7–11 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) broad, 7–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}$′) thick, blackish-brown, wrinkled, hilum and micropyle near ridge on convex side; stalk scar; pericarp tough, 1 Mm. ($\frac{1}{25}$′) thick, 1 urn-shaped seed, taste bitter, seed intensely bitter. Powder, brown—epicarp fragments with alkalies—reddish-brown, fixed oil globules, aleurone grains, acicular crystals soluble in diluted hydrochloric acid, fibers, tracheæ; contains (seed)—picrotoxin, anamirtin (cocculin, not bitter or poisonous), fat; (pericarp, nearly tasteless)—menispermine, paramenispermine, hypopicrotoxic acid, resin. *Picrotoxin* (picrotoxinum), $C_{30}H_{34}O_{13}$—U.S.P. 1880–1890, not a single body, but composed of picrotoxin 54 p. c., and picrotin 46 p. c.; obtained by evaporating to syrup a tincture made with hot alcohol, removing fat, boiling residue with water, filtering, which deposits picrotoxin upon cooling. It is in colorless, shining prismatic crystals or powder, odorless, very bitter, soluble in alcohol, ether, chloroform; with $H_2SO_4 + NaNO_3 + NaOH$ gives brick-red, fading in few hours. Cerebrospinal excitant, nervine, antiparasitic, with combined action of belladonna and nux vomica; slows heart and respiration, causes spasms of flexors, death by paralyzing heart; convulsions resemble epileptic paroxysms (circular spasms)—those of strychnine being tonic (tetanic), affecting the extensors; paralysis (laryngeal), epilepsy, chorea, eclampsia, chronic spasms of the limbs, vomiting with giddiness, morphine antidote: externally—parasitic skin diseases, itch, lice, ringworm (avoiding abraded surfaces); powdered berries, mixed with dough, sometimes thrown upon water in order to catch fish; after eating this, fish whirl around, become stupefied, and lie motionless upon the surface, so that they may readily be picked up; berries also prevent secondary fermentation of alcoholic liquors, adding strength thereto, but dangerous. *Poisoning:* Symptoms and treatment similar to strychnine. Dose, seed, gr. 1–3 (.06–.2 Gm.); 1. *Tinctura*

Cocculi, 10 p. c. (diluted alcohol), dose, ♏ij–15 (.13–1 cc.)—externally to destroy parasites; picrotoxin, gr. $\frac{1}{64}$–$\frac{1}{32}$ (.001–.002 Gm.); menispermine, gr. 1–2 (.06–.13 Gm.); *decoction,* 2.5 p. c.; *ointment,* 2 p. c.

Fig. 134.—*Anamirta Cocculus (paniculata).*

a *b* *c*

Fig. 135.—*Anamirta Cocculus: a,* staminate flower; *b,* longitudinal section of fruit, magnified; *c,* fruit and section, normal size.

3. *Chondroden'dron tomento'sum, Parei'ra, Parei'ra Bra'va, N.F.*—The dried root with not more than 5 p. c. of stems nor 2 p. c. of other

MENISPERMACEÆ

foreign organic matter; Brazil, near Rio Janeiro, Peru. Tall woody climber; stem 1–10 Cm. ($\frac{2}{5}$–4′) thick; bark rough, with elevated prominences; leaves 12.5–30 Cm. (5–12′) long, ovate, cordate, petiolate, smooth above, finely woolly beneath; flowers diœcious, panicles; fruit purplish-black drupe, 6 in a bunch like grapes. Root subcylindrical, tortuous, in pieces 10–15 Cm. (4–6′) long, 1–6 Cm. ($\frac{2}{5}$–2′) thick, brownish, furrowed, hard, heavy, tough; internally brownish-gray, waxy luster (fresh), several successive concentric zones of fibro-vascular bundles, each 2–4 Mm. ($\frac{1}{12}$–$\frac{1}{6}$′) wide, separated by zones of parenchyma

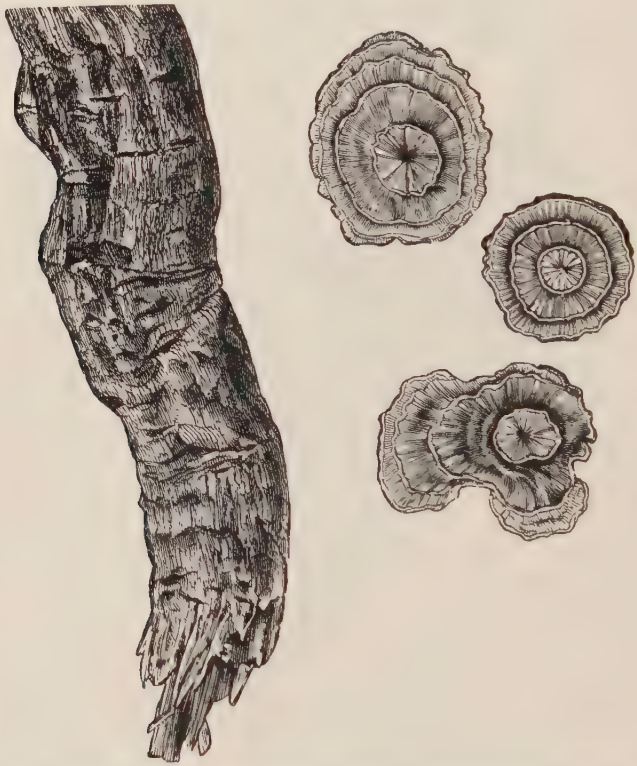


Fig. 136.—Pareira (brava): portion of a root and transverse section of the same.

and stone cells, prominent medullary rays; stems grayish, usually covered with lichens, without waxy luster; odor slight; taste bitter. Powder, dark brown—numerous starch grains, tracheæ, wood-fibers, stone cells, brownish cork; bluish-black with iodine T. S.; solvents: 70 p. c. alcohol, boiling water; contains pelosine (cissampeline—identical with bebeerine, buxine, paricine), tannin, starch, gum, ash 6–11 p. c. Diuretic, tonic, laxative; cystitis, calculi, gonorrhea, leucorrhea, dropsy, rheumatism, jaundice; natively for bites of poisonous serpents (leaves to wound, vinous infusion internally). Dose, ℥ss–1 (2–4 Gm.);

1. *Fluidextractum Pareiræ* (diluted alcohol), dose, ʒss–1 (2–4 cc.). *Extract*, gr. 10–20 (.6–1.3 Gm.). *Infusion, Decoction*, each, 5 p. c., ʒj–2 (30–60 cc.).

4. *Menisper'mum canaden'se, Yellow Parilla, Canadian Moonseed.*—The rhizome and roots, U.S.P. 1880–1890; N. America (Canada to S. Carolina). Perennial climber, 2.5–3.5 M. (8–12°) long; stem round, striate; leaves 10–12.5 Cm. (4–5′) broad, peltate, 3–5-lobed, pale beneath petioles long; flowers small, yellowish; fruit 8 Mm. ($\frac{1}{3}$′) thick, black, resembling grapes. Rhizome 1 M. (3°) long, 6 Mm. ($\frac{1}{4}$′) thick, yellowish-brown, knotty, wrinkled lengthwise, roots many, fracture tough, woody, inside yellowish, bark thick, wood-rays broad, porous, and longest on lower side, pith distinct; nearly inodorous; taste bitter;

Fig. 137.—*Menispermum canadense:* transverse section of rhizome magnified.

contains berberine (yellow), menispine, starch, gum, resin, tannin. Tonic, alterative, diuretic; similar to calumba (owing to its bitterness); scrofulous affections, as a substitute for sarsaparilla. Dose, gr. 15–60 (1–4 Gm.); fluidextract (alcohol 65 p. c.), ʒss–1 (2–4 cc.).

5. *Cissam'pelos parei'ra* (Gr. κισσός, ivy, + ἄμπελος, a vine).—W. Indies, C. America. Root and stem 6–25 Mm. ($\frac{1}{4}$–1′) thick, not concentric, wood in 20 porous wedges, separated by narrow medullary rays, bark brownish-gray, suberous; lighter than pareira, non-waxy, and the infusion gives no blue color with tincture of iodine.

6. *Bol'du Bol'dus, Boldus, Boldo, Boldo Leaves, N.F.*—Monimiaceæ. The dried leaf with not more than 2 p. c. of stems or other foreign organic matter, yielding not more than 6 p. c. of acid-insoluble ash;

LAURACEÆ

S. America, Chile. A large aromatic evergreen diœcious shrub. Leaves ovate, 3–7 Cm. (1½–3′) long, 1–4 Cm. (⅖–1⅗′) broad, base and apex rounded or indented, entire, revolute, thick coriaceous, rigid, brittle, pale green, papillose, petiole stout; odor peculiar, disagreeable (crushed) chenopodium-like; taste bitter, warm, pungent, camphoraceous, terebinthinate. Powder, greenish—parenchyma, volatile oil cells, calcium carbonate cystoliths, hairs, numerous stomata; contains volatile oil, resin, boldine, boldoglucin (glucoside—liquid), tannin. Sedative, hypnotic; tonic; atonic dyspepsia, nervousness, hepatitis, rheumatism, urethritis. Dose, gr. 5–10 (.3–.6 Gm.); 1. *Fluidextractum Boldi* (alcohol). *Tincture*, 20 p. c. ♏v–20 (.3–1.3 cc.), boldine—local anesthetic, gr. 3 (.2 Gm.).

25. LAURACEÆ. Laurel Family.

La-ra′se-e. L. *Laur-us* + aceæ, bay tree, fr. Celtic *blaur* (*laur*, the *b* dropped), signifying green—*i. e.*, referring to plant's foliage. Trees, shrubs. Distinguished by being aromatic (volatile oils); leaves simple, pellucid-dotted; flowers polygamous, calyx 4–6, in 2 rows, petaloid, regular; stamens perigynous, distinct, anthers opening by 2–4 uplifted valves; ovary 1-celled; ovules 1 in each cell; fruit drupe or berry; tropics, temperate climates; aromatic, stimulant (vol. oil), narcotic, sudorific, tonic, stomachic, febrifuge, astringent; timber, some fruit edible.

Genera: **1. Cinnamomum. 2. Sassafras.**

CINNAMOMUM. CINNAMON, *U.S.P.*

Cinnamomum Loureirii, *Nees.* { The dried bark, yielding not less than 2 p. c. of volatile ether-soluble extractive.

Habitat. Annam (Cochin China).

Syn. Cinnam., Cinnamomum Saigonicum, Annam—China—God's Cinnamon, Annam Cassia, Cortex Cinnamomi Saigonici; Fr. Cannelle de Saigon; Ger. Saigonzimt.

Cin-na-mo′mum. L. fr. Ar. *kinnamon*, cinnamon, probably connected with *qanch*, a reed, cane—*i. e.*, resemblance of stems; or Malay *kaju manis*, sweet wood, from its aromatic odor and taste.

Lou-rei′ri-i. L. *Loureiri-um* in honor of Jean de Loureiro, 1710–1791—*i. e.*, a celebrated Portuguese botanist and writer, author of *Flora Cochinchinensis*, and other important works.

Sa-i-gon′i-cum. L. belonging to Saigon, a country and city in Southern Annam—*i. e.*, its native habitat.

Plant.—Handsome evergreen tree, 6–9 M. (20–30°) high, trunk .3–.5 M. (12–18′) thick, young twigs slightly quadrangular; leaves coriaceous, 3–5-nerved, but only midrib reaches apex, bright glossy-green above, glaucous beneath, 10–20 Cm. (4–8′) long; flowers Jan.–March, small, hermaphrodite or polygamous, fleshy, black, ovoid, size of small olive, adhering, like acorn, to cup-shaped perianth. Bark, in quills, 30 Cm. (12′) long, 4 Cm. (⅘′) broad; bark .5–3 Mm. (1/50–⅛′)

thick, light brown, dark purplish-brown with grayish patches of crustose lichens and numerous bud-scars, finely wrinkled, especially that of younger twigs, otherwise rough from corky patches surrounding the lenticels; inner surface reddish-brown, dark brown, granular, slightly striate; fracture short—inner bark porous from large oil and mucilage cells, and separated from the outer by a layer of stone cells; odor characteristic, aromatic; taste sweetish, aromatic, pungent; POWDER, yellowish-brown—numerous starch grains; single and 2–4-compound, single grains .005–.025 Mm. ($\frac{1}{5000}$–$\frac{1}{1000}$'), stone cells irregular, bast-fibers with slightly lignified walls; parenchyma, reddish-brown walls; oil and mucilage cells. *Solvents:* alcohol; hot water partially. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 138.—Cinnamomum twig, showing leaf venation.

ADULTERATIONS.—BARK: *Saigon*—Cassia bark, and a closely resembling bark of unknown derivation, having lighter gray color and coarser structure identified by weak odor and taste; possibly unscraped Guava bark quills, and clove bark; *Ceylon*—Scarcely possible in the entire state; POWDER: Neither Saigon or Ceylon found on the market, all so labeled being cassia, which is subject to endless admixtures—chips, siftings, buds, walnut-shells, oil stone, flour, sand, beans, grains, starch, clove-buds—exhausted drug, by percolation, distillation; ash (sometimes) 8–10 p. c.; OIL: That distilled from flowers and roots. phenol, oil of clove, petroleum, colophony, lead.

a *b*

FIG. 139.—Cinnamomum: *a*, flower; *b*, vertical section of the same.

Commercial.—Cinnamon was a very early favorite spice, being brought by Arabian navigators to the Phœnicians, Grecians, and Romans, the Chinese cassia being used first, the Ceylon not until 1275. While there are about 50 species growing wild, only a few yield the

commercial bark—this resulting mostly from cultivated plants. At one time Ceylon excelled in the industry, but there coffee largely has replaced it, thus restricting to the neighborhood of Colombo the principal cinnamon gardens; however, S. China has become equally interested in the cultivation and as a result produces much valuable bark. There are two important varieties: 1, *Saigon, Annam Cassia* (*Cinnamon, U.S.P.*), thought to be entirely from wild trees (*C. Loureiri'rii*, and other species), growing in the mountainous districts of Annam. While chips and thick trunk-bark sometimes reach us, most is from branches and small stems, all being of good quality—sweet,

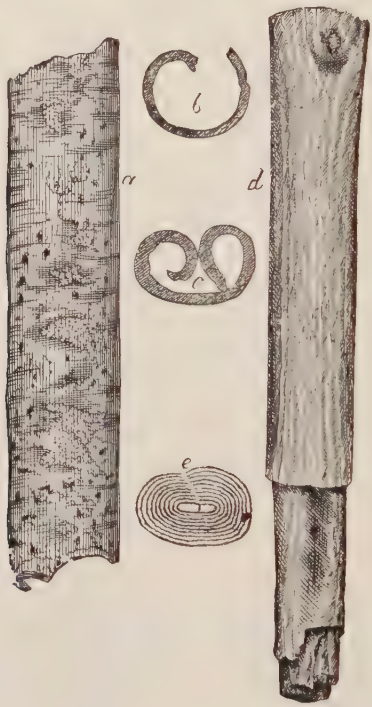


FIG. 140.—Cinnamomum: *a*, *b*, *c*, from China; *d*, *e*, from Ceylon.

aromatic, almost void of astringency and bitterness; some consider it high-grade cassia, but its own specific structure, area of growth, and absence of objectionable qualities in the corky layer seem to preclude such a possibility; certainly it is related more closely to cassia than to Ceylon, and may be an inferior grade (from one or more species distinct from *C. Cassia*) of that distinctive Chinese cinnamon so highly prized by the natives; 2, *Ceylon* (*Cinnamon*), formerly in U.S.P., considered best, being nearly all from cultivated plants through the process of pollarding, so that in 2–3 years many slender stems are produced with bark devoid of astringent and corky layer, this latter

not yet having had time to form. The cultivation of cinnamon begins with the planting of seed in prepared soil, 4–5 in each hill, from which, in 5–6 years, the straight stems due to continued pruning, 1.5–3 M. (5–10°) high, are cut down with catty-knives, and by coppicing a new crop of twigs is formed every 2–3 years. The barking (March–June, after which delicacy and aroma lessen) takes place under cover by making 2 equidistant longitudinal incisions and transverse ones every few feet apart, then teasing off easily with a mama-knife (Saigon); the bark may now be allowed to wilt or undergo partial fermentation for several days, becoming soft and pliable, thus facilitating epidermal separation, when it is laid concave downward and scraped to the layer of stone cells, thereby rejecting the bitter or astringent portion (Ceylon); congeries of quills are formed, which when dried (first by shade, then by sun) are made into 30-pound (14 Kg.) bundles and marketed as to quality in *firsts*, *seconds*, *thirds*, the inferior grades being distilled for oil; or each quill is dried separately (Saigon) and tied into bundles for exportation. The bark is imported loose or in bundles with split bamboo bands from Canton, Hong Kong (Saigon), Calcutta, Colombo.

CONSTITUENTS.—Volatile oil .5–2 p. c., tannin 3–5 p. c., resin, bitter principle, sugar, mannite, starch, mucilage, ash 6 p. c., of which 2 p. c. is insoluble in diluted hydrochloric acid.

Oleum Cinnamomi. Oil of Cinnamon, *U.S.P.*—(Syn., Ol. Cinnam., Oleum Cassiæ, U. S. P. 1910, Cassia Oil, Oleum Cinnamomi Cassiæ, Oil of Chinese Cinnamon; Fr. Essence (Huile) de Cannelle de Chine; Ger. Zimtöl, Zimtkassienöl.) This volatile oil distilled from the leaves, twigs, and waste bark of *Cinnamomum Cassia* (Chinese), and rectified by steam distillation, is a yellowish, brownish liquid, darker and thicker by age and exposure, characteristic odor and taste of cassia cinnamon, sp. gr. 1.055 soluble in alcohol (1), glacial acetic acid (1), 70 p. c. alcohol (2), optically almost inactive; contains at least 80 p. c. of cinnamic aldehyde, C_9H_8O (oxidizing into resin and cinnamic acid) upon which the value depends, also cinnamyl acetate, $C_9H_9C_2H_3O_2$ (liquid of unpleasant acrid taste), and phenyl-propyl acetate, ortho-cumaric aldehyde, cinnamic acid, $C_9H_8O_2$; this latter is not in fresh oil, and after being formed becomes, by further oxidation, benzoic acid. *Tests:* 1. Shake oil (2) with purified petroleum benzin (5–10)—decanted liquid is colorless and gives no green color when shaken with equal volume of (1 in 1000) copper acetate solution (abs. of rosin or rosin oils). 2. Thoroughly wash a 1000 cc. beaker and a filter paper free of chlorides; place 3 or 4 drops of oil on a clean watch glass on triangle, ignite, immediately cover with moistened beaker; wash products of combustion through washed filter paper with 10–20 cc. distilled water, acidulate filtrate with 1 drop nitric acid, add 1 drop silver nitrate T. S.—no turbidity (abs. of chlorinated products). Should be kept cool, dark, in well-stoppered, amber-colored bottles. The Ger. P. and U. S. P. recognize only the oil of Chinese cinnamon (cassia),

while the Br. P. and Fr. Codex that of Ceylon cinnamon; the former is more abundant and cheaper, the latter of finer flavor and more delicate aroma, containing besides cinnamic aldehyde, some eugenol and phellandrene. Dose, ♏j–5 (.06–.3 cc.).

PREPARATIONS.—1. BARK: 1. *Tinctura Cardamomi Composita,* 2.5 p. c. 2. *Tinctura Gambir Composita,* 2.5 p. c. 3. *Tinctura Lavandulæ Composita,* 2 p. c. 4. *Tinctura Rhei Aromatica,* 4 p. c. 5. *Syrupus Cinnamomi, N.F.,* 10 p. c. 6. *Tinctura Cinnamomi, N.F.,* 20 p. c. (glycerin 7.5 p. c., alcohol 67.5, water 25. Dose, ʒss–2 (2–8 cc.): Preps.: 1. *Elixir Taraxaci Compositum, N.F.,* 3 p. c. 2. *Mistura Rhei Alkalina, N.F.,* 6.4 p. c. 7. *Pulvis Aromaticus, N.F.,* 35 p. c. + ginger 35, cardamom seed 15, myristica 15. 8. *Pulvis Aromaticus Rubefaciens, N.F.,* 30 p. c., cinnamon 30, clove 30, ginger 20, capsicum 20. 9. *Pulvis Cretæ Aromaticus, N.F.,* 8 p. c. 10. *Syrupus Sennæ Aromaticus, N.F.,* $\frac{2}{5}$ p. c. 11. *Tinctura Antiperiodica, N.F.,* $\frac{1}{13}$ p. c. 12. *Tinctura Aromatica, N.F.,* 10 p. c. + ginger 4, galangal 2, clove 2, cardamom seed 2. 13. *Tinctura Opii Crocata, N.F.,* $\frac{3}{5}$ p. c. 14. *Tinctura Opii et Gambir Composita, N.F.,* $\frac{1}{40}$ p. c. 15. *Tinctura Viburni Opuli Composita, N.F.,* 6.5 p. c.

II. OIL: 1. *Aqua Cinnamomi.* Cinnamon Water. (Syn., Aq. Cinnam.; Fr. Eau de Cannelle; Ger. (Einfaches) Zimtwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ; triturate oil .2 cc. with purified talc 1.5 Gm., recently boiled distilled water q. s. 100 cc., filter until clear. Dose, ʒss–1 (15–30 cc.).

Preps.: 1. *Infusum Digitalis* (1.5 p. c.)—15 p. c. 2. *Mistura Cretæ,* 40 p. c. 3. *Liquor Ferri Albuminati, N.F.,* 20 p. c. 4. *Syrupus Ipecacuanhæ et Opii, N.F.,* 3.2 p. c. 5. *Tinctura Rhei Aquosa, N.F.,* 12.5 p. c.

2. *Spiritus Cinnamomi.* Spirit of Cinnamon. (Syn., Sp. Cinnam.; Fr. Alcoolat de Cannelle; Ger. Zimtspiritus.)

Manufacture: 10 p. c. Dissolve oil 10 cc. in alcohol q. s. 100 cc. Dose, ♏v–30 (.3–2 cc.).

Preps.: 1. *Syrupus Rhei,* $\frac{2}{5}$ p. c. 2. *Syrupus Ipecacuanhæ et Opii, N.F.,* $\frac{2}{5}$ p. c. 3. *Tabellæ Phenolphthaleini, N.F.,* $\frac{1}{50}$ ♏.

3. *Acidum Sulphuricum Aromaticum,* $\frac{1}{10}$ p. c. 4. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{50}$ p. c. 5. *Acetum Aromaticum, N.F.,* $\frac{1}{20}$ p. c. 6. *Dentifricium, N.F.,* .175 p. c. 7. *Fluidglyceratum Cascaræ Sagradæ Aromaticum, N.F.,* $\frac{1}{10}$ p. c. 8. *Lavatio Ori, N.F.,* $\frac{1}{2}$ p. c. 9. *Liquor Pepsini Aromaticus, N.F.,* $\frac{1}{40}$ p. c. 10. *Mistura Oleo-Balsamica, N.F.,* $\frac{2}{5}$ p. c. 11. *Nebula Aromatica, N.F.,* $\frac{1}{5}$ p. c. 12. *Nebula Mentholis Composita, N.F.,* $\frac{1}{5}$ p. c. 13. *Odontalgicum, N.F.,* 17 p. c. 14. *Oleum Ricini Aromaticum, N.F.,* $\frac{3}{10}$ p. c. 15. *Spiritus Cardamomi Compositus, N.F.,* 1 p. c. 16. *Spiritus Vanillini Compositus, N.F.,* $\frac{1}{2}$ p. c. 17. *Syrupus Rhamni Catharticæ, N.F.,* $\frac{1}{50}$ p. c.

Unoff. Preps.: BARK: *Fluidextract,* ♏v–30 (.3–2 cc.). *Infusion,* ʒj–2 (30–60 cc.).

PROPERTIES.—Carminative, stomachic, stimulant, astringent, hemostatic, aromatic, antispasmodic, germicide. The oil has no astringency.

USES.—Diarrhea, flatulence, nausea, vomiting, menorrhagia, parturient, to correct griping medicines; for flavoring preparations, chocolate, etc.

Allied Products:

1. *Cinnaldehydum, Cinnamic Aldehyde,* C_5H_8O, U.S.P. 1900.—Obtained as a natural product by shaking oil of cassia with aqueous solution of acid sodium sulphite, filtering, washing crystalline magma with alcohol, decomposing with diluted sulphuric acid, or synthetically by oxidation of cinnamyl alcohol by dry distillation of a mixture of calcium cinnamate and formate, or as a condensation-product by acting on benzaldehyde (10), acetaldehyde (15) with hydrochloric acid gas, or with 10 p. c. solution of sodium hydroxide (10) + water (900). It is a colorless liquid, cinnamon-like odor, burning, aromatic taste, sp. gr. 1.047, boils at 250° C. (482° F.) with partial decomposition, optically inactive, solidified with ice and salt should melt at —7.5° C. (18.5° F.), soluble in alcohol, ether, fixed or volatile oils, sparingly in water; contains at least 95 p. c. of pure cinnamic aldehyde. Similar to oil of cinnamon, for which it may be substituted. Should be kept in well-stoppered, small, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

2. *Cinnamomum Cassia (aromat'icum), Chinese Cinnamon.*—The dried bark of the shoots deprived of most of the corky portion, U.S.P. 1820-1890; China. Plant—handsome tree, but bark removed when 5–6 years old, occurring in quills 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) broad, bark 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, deprived of corky layer, yellowish-brown, often with grayish patches, rough, inside nearly smooth, faintly striate, fracture nearly smooth; odor fragrant; taste sweet, aromatic, pungent, astringent. The outer layers are simply imperfectly removed by curved knives or planes, those of iron being avoided, consequently can be recognized readily by having undergone this treatment, also by its more irregular zone of stone cells, the greater abundance of bast-fibers and tannin. This bark is very irregular in quality, owing to its varied origin, and accordingly is recognized in commerce as Cassia, Cassia vera, Cassia lignea, etc. *C. Burman'ni* is believed to yield the Sumatra, also a portion of the Java, China, Timor; *C. Tam'ala,* some of the Calcutta, N. India, Cochin China; *C. i'ners,* part of E. Indian archipelago.

3. *Cassia Buds, Flores Cassiæ.*—These are the small, stem-like immature fruits of various species, somewhat resembling, but smaller than clove, having fine cinnamon odor and taste; contain oil of cinnamon, tannin, etc.

CAMPHORA. CAMPHOR, *U.S.P.*

Cinamomum Camphora, *(Linné) Nees et Ebermaier.* { The dextrorotatory ketone (concrete volatile oil).

LAURACEÆ

Habitat. China, Japan, Formosa. Tree cultivated in Italy as an ornament, and may yield profitably in California, Florida, etc., wherever frosts are light.

Syn. Camph., Camphor Laurel, Gum Camphor Tree; Fr. Camphre du Japon —droit; Ger. Kampfer, Kampher, Campfer.

Cam'pho-ra. L. fr. Ar. *kafur* or *kapur*, chalk, lime—*i. e.*, its resemblance.

PLANT.—Handsome evergreen tree, 9–12 M. (30–40°) high, .3–.6 M. (1–2°) thick, much branched above, fragrant; bark smooth, green; leaves 7.5–15 Cm. (3–6′) long, 2.5–7.5 Cm. (1–3′) broad, attenuated toward both ends, entire, smooth, shining, ribbed, bright yellowish-green above, paler and glaucous beneath, thick; flowers, June–July,

FIG. 141.—*Cinnamomum Camphora.*

small, whitish; fruit, Nov.–Dec., purple berry, 6 Mm. (¼′) thick, 1-seeded. DEXTROROTATORY KETONE (camphor), in white, translucent, tough masses, granules, penetrating, characteristic odor, pungent, aromatic taste, soluble in alcohol (1), chloroform (1), ether (1), carbon disulphide, petroleum benzin, fixed or volatile oils, water (800), sp. gr. 0.990; readily pulverized with a little alcohol, chloroform, ether, and liquefied with equal quantity of chloral hydrate, menthol, phenol, thymol; volatilizes at ordinary temperature, melts at 175° C. (347° F.). *Tests:* 1. Heat 2 Gm.—sublimes without carbonization, leaving about .05 p. c. of non-volatile matter. 2. Solution in petroleum benzin

(1 in 10)—clear (abs. of water). 3. A copper spiral 6 Mm. ($\frac{1}{4}'$) in diameter and 6 Mm. ($\frac{1}{4}'$) long held in flame until it glows without coloring flame green, then dipped into camphor; ignited, burned outside of flame; then in lower outer edge—no green color—(abs. of chlorinated products); alcoholic solution precipitates with water. *Impurities:* Chlorinated products, water. Should be kept cool, in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.).

Commercial.—Tree, resembling sassafras and linden, is of slow growth but flourishes up to 600 M. (2,000°) elevation in the tropics —Cape of Good Hope, Brazil, Jamaica, Madeira, Mediterranean region, etc. The wood is valuable, being white, fragrant and repellent to insects, and while all parts contain camphor, along with its strong odor, it is obtained only from the root, trunk, and branches of trees fifty or more years old—by sublimation. In Japan roots and small branches are chipped and put, with some water, in large vessels surmounted by earthen domes lined with rice-straw; on applying heat the camphor, volatilized by steam, rises to the domes and condenses upon the straw—flowers of camphor—from which it is shaken and packed in double-tubs, 100 pounds (45 Kg.). In China the comminuted plant is boiled with water until camphor adheres to the ladle and the strained liquid concentrates upon cooling, which then is sublimed with alternating layers of earth. In Formosa (island) a long wooden trough, coated with clay and fixed over a crude furnace, is half-filled with water and, upon a perforated board luted to the top, chips are placed, that in turn are covered with inverted pots; on applying heat steam is produced, which, rising, passes through the perforations and chips, thereby becoming camphor-vapor that condenses in the upper part of the pots—flowers of camphor—from which it is scraped every few days. This industry here has been monopolized and revolutionized by Japan since her last war with China, to the effect of improving quality, the government purchasing from all producers their product of a recognized standard, and refining it at Taihoku, using several thousand pounds at a charge—the oil and water being first driven off at low heat, then the camphor sublimed at higher temperature, and pressed hydraulically into blocks for exporting. The crude is forwarded often in leaf-lined baskets, 70 pounds (32 Kg.), to Tamsui, Takow, etc., there stored in vats, or packed in chests, tubs (lead- or tin-lined), 100 pounds (45 Kg.), which prior to shipping, are saturated with water to prevent loss of weight by evaporation in transit, causing it to reach us somewhat moist. When in vats a yellowish-brown volatile oil—oil of camphor—drains out, the amount increasing with pressure. There are two varieties: 1, *Japan* (*Tub, Dutch*—they being the first to introduce it), lighter pink, larger grained, higher priced, cleaner, dryer; usually from Batavia; 2, *China* (*Formosa*), cheapest, most abundant; usually from Canton. As such "crude camphor" contains 2–10 p. c. of *impurities*—vegetable matter, gypsum, salt, sulphur, chips, ammonium chloride, chlorinated products, etc.—which must be removed before suitable for medicine.

Refining.—Formerly done exclusively in Europe, but now largely in Formosa and our country, by mixing crude camphor with $\frac{1}{50}$ part of quicklime (iron filings, sand, or charcoal) to remove resin, empyreumatic oil, moisture, etc., then resubliming at 175–204° C. (347–400° F.) in iron, copper or glass retorts, and pressing into rectangular blocks or circular cakes.

ADULTERATIONS.—Rare: Stearic acid 25–50 p. c., insoluble in alcohol except when hot, crystallizing therefrom upon cooling; cane-sugar (sucrose) 20 p. c.

CONSTITUENTS.—$C_{10}H_{16}O$. When heated with zinc chloride yields cymol, $C_{10}H_{14}$; with nitric acid yields camphoric acid, $C_{10}H_{16}O_4$, and camphoronic acid, $C_9H_{12}O_6$; the former acid forms colorless, inodorous prisms (see page 232); the latter acid melts at 136° C. (277° F.) with decomposition and is freely soluble in water or alcohol.

PREPARATIONS.—1. *Aqua Camphoræ.* Camphor Water. (Syn., Aq. Camph., Aqua Camphorata, Mistura Camphoræ; Fr. Eau camphré; Ger. Kampferwasser.)

Manufacture: $\frac{1}{5}$ p. c. Triturate powdered camphor .2 Gm. with purified talc 1.5 Gm. + distilled water 100 cc., agitate well, set aside 24 hours, filter repeatedly until clear; it is a saturated solution. Dose, ʒj–8 (4–30 cc.).

2. *Linimentum Camphoræ.* Camphor Liniment. (Syn., Lin. Camph., Camphorated Oil, Linimentum Camphoratum; Fr. (Liniment) Huile camphré; Ger. Oleum Camphoratum, Kampferöl, Kampferliniment.)

Manufacture: 20 p. c. Heat in a flask on water-bath cottonseed oil 80 Gm., add camphor 20, stopper container and agitate occasionally until dissolved without further heating; used externally.

Prep.: 1. *Ceratum Camphoræ, N.F.*, 10 p. c.

3. *Spiritus Camphoræ.* Spirit of Camphor. (Syn., Sp. Camph., Tinctura Camphoræ, Tincture of Camphor, Alcohol Camphoratus; Fr. (Esprit de) Alcool camphré; Ger. Spiritus camphoratus, Kampferspiritus.)

Manufacture: 10 p. c. Dissolve 10 Gm. camphor in alcohol 80 cc., add alcohol q. s. 100 cc., sp. gr. 0.825. *Test:* 1. To 5 cc. add .05 Gm. of anhydrous potassium carbonate—latter does not liquefy or adhere to bottom of container (abs. of added water). Dose, ♏v–60 (.3–4 cc.).

Preps.: 1. *Lotio Ammoniacalis Camphorata, N.F.*, 1 p. c. 2. *Mistura Opii et Chloroformi Composita, N.F.*, 20 p. c. 3. *Mistura Opii et Rhei Composita, N.F.*, 20 p. c. 4. *Tinctura Opii et Gambir Composita, N.F.*, 4 p. c.

4. *Linimentum Saponis*, 4.5 p. c. 5. *Linimentum Chloroformi*, 3.15 p. c. 6. *Tinctura Opii Camphorata*, $\frac{2}{5}$ p. c. 7. *Ampullæ Camphoræ, N.F.*, $3\frac{1}{2}$ gr. 8. *Chloral Camphoratum, N.F.*, each, 50 p. c. 9. *Emplastrum Fuscum Camphoratum, N.F.*, 1 p. c. 10. *Linimentum Saponato-Camphoratum, N.F.*, 2.5 p. c. 11. *Menthol Camphoratum, N.F.*, 47.5 p. c. 12. *Petroxolinum Chloroformi Camphoratum, N.F.*, 20 p. c. 13. *Petroxolinum Phenolis Camphoratum, N.F.*, 37.5 p. c. 14. *Pilulæ Opii*

et Camphoræ, N.F., 2 gr. 15. *Unguentum Camphoræ, N.F.*, 22 p. c. 16. *Linimentum Belladonnæ, N.F.*, 5 p. c. 17. *Linimentum Opii Compositum, N.F.*, 1.75 p. c. 18. *Linimentum Sinapis Compositum, N.F.*, 6 p. c. 19. *Nebula Aromatica, N.F.*, $\frac{3}{10}$ p. c. 20. *Nebula Mentholis Composita, N.F.*, 1 p. c. 21. *Pilulæ Antiperiodicæ, N.F.*, $\frac{1}{8}$ gr. 22. *Tinctura Antiperiodica, N.F.*, $\frac{1}{5}$ p. c.

Unoff. Preps.: Linimentum Camphoræ Ammoniatum (Br.) 12.5 p. c., + stronger ammonia water 25 p. c.; *Vinum Camphoratum. Camphora Phenolata, Camphora Salicylata*, etc. Enters universally into camphor-ice, dentifrices, etc.

Properties.—Antispasmodic, stimulant, carminative, stomachic, (anjaphrodisiac, antipyretic, nervine, sedative, diaphoretic, rubefacient, resolvent, antiseptic. Has great healing powers; dilates vessels, increases flow of gastric juice and peristalsis.

Uses.—Camphor was not known to Greeks or Romans, we having derived it from the Arabians, who use it solely as a refrigerant and to lessen sexual desire. Now employed in hysteria, dysmenorrhea, nervousness, diarrhea, colic, flatulence, rheumatism, gout, tenesmus, asthma, cough, coryza, toothache, headache, spasms, chorea, epilepsy, nausea, typhoid condition, mania. Externally as a wash, liniment, or ointment for ulcers, gangrene, scabies, sprains, bruises, rheumatic pains, convulsions.

Poisoning: Have burning pain, vomiting, weak pulse, giddiness, debility, pallor, cold, clammy skin, faintness, confused ideas, delirium, convulsions, death from collapse; does not kill healthy adults. Give water at once if camphor taken in alcoholic solution, induce vomiting, follow with alcohol in small but frequent doses, coffee, cold, arterial sedatives, ether, artificial heat, castor oil; opium and bromides for the convulsions.

Incompatibles: Aconite, acids, neutral salts, water precipitates all solutions.

Synergists: Antispasmodics, alcohol, opium, narcotics, aromatics, all in small quantity.

Allied Products:

1. *Camphora Monobromata. Monobromated Camphor*, $C_{10}H_{15}BrO$. —This ortho-monobromcamphor is obtained by heating together in a flask or retort camphor and bromine in molecular proportions (preferably with a little water or chloroform) until reaction ceases, allowing yellowish solution to crystallize, heating until mass becomes white, recrystallizing from alcohol or petroleum benzin. It is in colorless prismatic needles, scales, or powder, mild, characteristic, camphoraceous odor and taste, permanent, decomposed by exposure to sunlight, soluble in alcohol (6.5), chloroform (.5), ether (1.6), almost insoluble in water; melts at 75° C. (167° F.). Nervous sedative in nervous irritation, insomnia, headache—no advantages over camphor. Dose, gr. 1–5 (.06–.3 Gm.), in pill, emulsion.

LAURACEÆ

2. *Acidum Camphoricum, Camphoric Acid,* $C_{10}H_{16}O_4$, U.S.P. 1900. —This dibasic organic acid is obtained by oxidizing camphor 150 Gm. with hot nitric acid 2000 cc., until crystallization takes place, dissolving crystals in water (5) containing sodium carbonate, allowing solution of sodium camphorate to crystallize, dissolving crystals in water (10), decomposing with hydrochloric acid, when camphoric acid crystallizes out. It is in colorless, odorless, monoclinic prismatic crystals, plates, acid taste, melting at 187° C. (369° F.), soluble in alcohol, ether, chloroform, fatty oils, water (125). Antihydrotic, antiseptic, intestinal disinfectant, anticatarrhal; bronchitis, catarrh, cystitis, night-sweats of phthisis, diarrhea, sore throat, pyelitis, eczema, acne. Dose, gr. 5–30 (.3–2 Gm.); locally in 2–6 p. c. aqueous solutions, with 11 p. c. of alcohol to each 1 p. c. of acid.

3. *Borneol, Borneo, Sumatra,* or *Barus Camphor* (*Dryobal'anops aromat'ica* (*Camphora*)), $C_{10}H_{18}O$, has different odor from official camphor, heavier than water, less volatile, with nitric acid yields ordinary camphor.

4. *Ngai Camphor* (*Blu'mea balsamif'era*).—This is a tall weed of India, China, Formosa. Its camphor has same composition as Borneo, but is levorotatory, and natively is prized higher than our official.

5. *Artificial Camphor.*—Although this can be made by oxidizing camphene, $C_{10}H_{16}$, with chromic acid mixture, yet the more recent process is based upon the interaction of anhydrous turpentine and anhydrous oxalic acid at 120–130° C. (248–266° F.), yielding pinyl oxalate and formate, which treated with lime gives borneol, and this by oxidation becomes camphor; however, the products terpin hydrate and terpene hydrochloride are recognized generally under this name—the latter being prepared by saturating oil of turpentine, dissolved in twice its volume of carbon disulphide, with hydrochloric acid gas, distilling with lime to form calcium chloride and camphene, oxidizing latter with nitric acid yielding camphor.

6. *Oleum Camphoræ, Camphor Oil,* U.S.P. 1860–1870.—This is a yellowish-brown volatile oil obtained from camphor by sublimation and expression; has camphor odor and taste, sp. gr. 0.940, dextrorotatory; contains pinene, phellandrene, cineol, dipentene, terpineol, safrol, eugenol, cadinene—at low temperature deposits camphor; used by Chinese for rheumatism, etc. Should not be confounded with Linimentum Camphoræ, *U.S.P.*, which also often is called oil of camphor (Ger. Oleum Camphoratum).

Allied Plants:

1. *Nectan'dra Rodiæ'i, Bebeeru Bark.*—The dried bark, U.S.P. 1860–1870; S. America, Guiana. Large tree, 18–24 M. (60–80°) high, bark ash-gray, smooth, leaves 12.5–15 Cm. (5–6′) long, 5–7.5 Cm. (2–3′) broad, coriaceous, shining; flowers yellowish-white, jasmine odor, wood strong (valuable in shipbuilding); fruit, subpyriform, 5–7.5 Cm. (2–3′) long, bitter. Bark flat pieces 6 Mm. ($\frac{1}{4}$′) thick, .3–.6 M. (1–2°) long, 10–15 Cm. (4–6′) broad, many longitudinal depressions, inside cinna-

mon-brown, coarsely striate, fracture granular, with stone cells, astringent, bitter; contains bebeerine (identical with buxine, paracine, and pelosine), siripine; wood has nectandrine. Tonic, antiperiodic, febrifuge; intermittents, menorrhagia, leucorrhea, headache, neuralgia, dyspepsia, consumption, in infusion, decoction. Dose, ʒss–1 (2–4 Gm.); bebeerine, gr. 1–10 (.06–.6 Gm.).

2. *Coto Bark.*—Bolivia. May be from *Dri'mys Win'teri* var. *granaten'sis.* In flat or curved pieces 12 Mm. (½′) thick, cinnamon color and odor, taste pungent, bitter; contains cotoin, $C_{14}H_{12}O_4$, hydrocotoin, protocotoin, volatile oil, resin. Dose, gr. 1–5 (.06–.3 Gm.); cotoin, gr. ¾–2 (.05–.13 Gm.).

3. *Paracoto Bark.*—Bolivia. 12 Mm. (½′) thick, sometimes with white fissured cork, odor nutmeg-like; contains paracotoin, $C_{12}H_{18}O_4$, hydrocotoin, leucotin, volatile oil, resin. Used like coto bark for diarrhea of typhoid, phthisis, sweating, cholera, nasal catarrh. Dose, gr. 5–10 (.3–.6 Gm.); fluidextract (90 p. c. alcohol); tincture 12.5 p. c. (alcohol), ʒss–1 (2–4 cc.); paracotoin, gr. 1–5 (.06–.3 Gm.).

4. *Ben'zoin* (*Lin'dera*) *Benzoin, Spice* or *Benjamin Bush.*—N. America, damp woods. Shrub 2–4.5 M. (6–15°) high, smooth; bark mostly used, berries and leaves to some extent; tonic, aromatic stimulant, diaphoretic; berries for allspice. Dose, gr. 15–60 (1–4 Gm.).

5. *Lau'rus no'bilis, Laurel, Sweet Bay.*—The leaves and fruit; Mediterranean Basin. Leaves 5–10 Cm. (2–4′) long, pellucid-punctate, smooth, aromatic, astringent; fruit (bayberries) oval drupes 12 Mm. (½′) long; contain volatile oil, fixed oil (Oleum Lauri) 30 p. c.; stimulant, astringent, stomachic.

SASSAFRAS. SASSAFRAS, *N.F.*

Sassafras Medulla. Sassafras Pith, *N.F.*

Oleum Sassafras. Oil of Sassafras, *U.S.P.*

Sassafras variifolium, (*Salisbury*) *O. Kuntze.* } A volatile oil distilled from the root.

Habitat. N. America—Canada, Florida to Texas; sandy, light soil, in the open.
Syn. Sassaf., Saxifrax, Saloop, Ague Tree, Cinnamon Wood; Sassafras (Cortex) Radix; Fr. Écorce de Sassafras; Ger. Lignum Sassafras, Sassafrasholz, Sassafrasrinde; Sassaf. Med.; Ol. Sassif., Sassafras Oil; Fr. Essence de Sassafras; Ger. Sassafrasöl.

Sas'sa-fras. L. *saxum,* rock, + *frangere,* to break—*i. e.,* grows in crevices of rocks; Sp. for *saxifrage,* name given by Monardes, Spanish botanist of 16th century.

Va-ri-i-fo'li-um. L. *varius,* varying, + *folium,* leaf—*i. e.,* leaves of several forms on the same tree, ovate, entire, 3-lobed and cuneate at base.

Plant.—Shrub in the North, tree in the South, 9–24 M. (30–80°) high, .3–.6 M. (1–2°) thick; wood whitish, reddish, light, strong,

LAURACEÆ

durable, aromatic; bark of stem and large branches rough, deeply furrowed, grayish, divisible into layers, young end-twigs smooth, green; leaves 10–15 Cm. (4–6′) long, varying shape; flowers, March-May, dicœcious, fragrant, appearing before leaves, small, greenish-yellow, racemes; fruit oval drupe, size of a pea, deep blue, 1-seeded. Bark — Sassafras, Sassafras, *N. F.* The dried bark of the root with not more than 4 p. c. of adhering wood, outer corky tissues or other foreign organic matter, yielding not more than 5 p. c. of acid-insoluble ash. It is in irregular, transversely curved or quilled pieces, 1–15 Cm. ($\frac{2}{5}$–6′) long, 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, orange-brown, nearly smooth, irregular ridges, inner surface reddish-brown, obscurely short-striate; fracture short, corky layer, yellowish-white inner bark; odor aromatic; taste slightly mucilaginous, astringent, pungent. Powder, reddish-brown—numerous starch grains, bast-fibers spindle-shaped, red masses of tannin, tracheæ. Dose, ʒss 1 (2–4 Gm.). Pith—Sassafras Medulla, Sassafras Pith, *N. F.* The dried pith (stem) with not more than 1 p. c. of foreign organic matter, yielding not more than .5 p. c. of acid-insoluble ash. It is in subcylindrical, curved pieces, 2–10 Cm. ($\frac{4}{5}$–4′) long, 2–5 Mm. ($1\frac{1}{2}$–$\frac{1}{5}$′) thick, light-weight, whitish, occasional wood fragments adhering; fracture short; odor slight, sassafras-like; taste mucilaginous; mounts in water—thin layer of mucilage from inner walls of cells; macerate several hours .5 Gm. with cold distilled water 25 cc., filter, mucilaginous solution with alcohol (1)—no precipitate, unless excess added.

FIG. 142.—*Sassafras variifolium:* 1, fruiting twig; 2, flowering twig.

a *b*

FIG. 143.—*Sassafras variifolium: a*, staminate flower; *b*, pistillate flower.

CONSTITUENTS.—I. BARK: Volatile oil 6–9 p. c., Sassafrid 9 p. c., tannin 6 p. c., resin, starch, gum, wax, ash 30 p. c. II. PITH: gum, volatile oil.

Oleum Sassafras. Oil of Sassafras.—This volatile oil distilled from the root (better—root-bark) with water or steam, is a yellow, reddish-yellow liquid, characteristic odor and taste of sassafras, soluble in 90 p. c. alcohol (2), solution being neutral, sp. gr. 1.070, dextrorotatory; contains chiefly safrol, $C_{10}H_{10}O_2$, 80 p. c., pinene and phellandrene, $C_{10}H_{16}$, 10 p. c., *d*-camphor 6.8 p. c., eugenol, $C_{10}H_{12}O_2$, .5 p. c., cadinene, residue 3 p. c. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

Sassafrid.—Supposed to be altered tannin, the result of oxidation, analogous to cinchona-red; some disclaim its presence in fresh bark; crystallizes in yellowish-brown granules, soluble in alcohol, insoluble in ether, solutions colored red by alkalies, precipitated by alkaline earths (carmine-red), ferric salts (greenish-brown), lead acetate (white) inodorous, nearly tasteless.

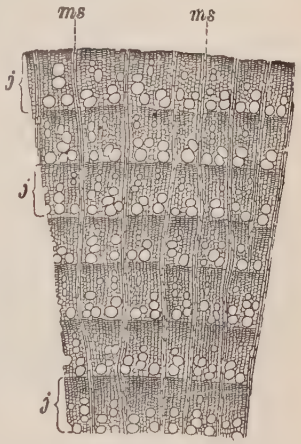


FIG. 144.—Sassafras wood: cross-section, magnified 20 diam.; *j*, annual rings; *ms*, medullary rays.

PREPARATIONS.—OIL: 1. *Syrupus Sarsaparillæ Compositus*, $\frac{1}{50}$ p. c. 2. *Syrupus Eriodictyi Aromaticus, N.F.*, $\frac{1}{20}$ p. c. 3. *Syrupus Pini Albæ Compositus, N.F.*, $\frac{1}{50}$ p. c. 4. *Syrupus Trifolii Compositus, N.F.*, $\frac{1}{25}$ p. c. BARK: 1. *Fluidextractum Sarsaparillæ Compositum, N.F.*, 10 p. c. 2. *Syrupus Pini Albæ Compositus, N.F.*, $\frac{7}{10}$ p. c. PITH: 1. *Mucilago Sassafras Medullæ, N.F.*, 3 p. c. Dose, *ad libitum*.

Unoff. Preps.: BARK: *Fluidextract*, ʒss-1 (2–4 cc.). *Infusion (Tea)*. Dose, *ad libitum*.

PROPERTIES.—Alterative, diaphoretic, stimulant, emmenagogue.

USES.—To purify blood, skin diseases, rheumatism, syphilis. Infusion valuable antidote for poison-ivy, internally and externally; it (tea) was popular at one time for so-called thinning the blood (alterative) in spring; given with sarsaparilla, guaiacum, mezereum, etc.; oil popular flavoring agent in confectionery, drinks, soaps, etc., antiemetic, antagonist to narcotic effects of tobacco, hyoscyamus, etc.

Derivative Products:

1. *Safrolum, Safrol*, $C_{10}H_{10}O_2$—$C_6H_3.C_3H_8.(OOCH_2)$.—This chemically is the methylene ether of allyl pyrocatechol, occurring in the oils of camphor, star-anise, cinnamon, etc., and constitutes 80 p. c. of the oil of sassafras. It is obtained chiefly from the red oil of camphor by collecting that fraction boiling at 230° C. (446° F.), purifying the same by repeated chilling and crystallization; it is a colorless or faintly

yellow liquid, sassafras-like odor, sp. gr. 1.105, optically inactive, cooled to —20° C. (—4° F.) solidifies to a mass of crystals, melting at 11° C. (52° F.), soluble in alcohol (1), 70 p. c. alcohol (30), miscible with ether, chloroform, boils at 233° C. (451° F.); heated with alcoholic potassium hydroxide solution forms isosafrol, which is less toxic than safrol; with bromine yields crystals of $C_{10}H_5Br_5O_2$. Reduces arterial pressure by depressing vasomotor center; taken a long period produces fatty degeneration of heart, liver, and kidneys; it is eliminated as piperonalic acid. Dose, ♏j–2 (.06–.13 cc.).

2. *Sassafras Lignum, Sassafras Wood.*—Contains little volatile oil; used like the bark, but very weak medicinally.

Allied Plant:

1. *Umbellula'ria califor'nica, California Bay Laurel* or *Spice Tree.*—Wood brownish, close-grained, esteemed for cabinet-work; leaves yield volatile oil 4 p. c., with nutmeg and cardamom odor; seed contain a fat; stimulant, anodyne in diarrhea, neuralgia, headache.

26. PAPAVERACEÆ. Poppy Family.

Pa-pav-e-ra'se-e. L. *Papaver* + aceæ, poppy, OE, *papy*, Gr. *μήκων*, classic name, fr. *papa*, pap or thick milk—*i. e.*, formerly used for children—to nourish and cause sleep. Herbs, shrubs, with milky or colored juice. Distinguished by the 2–3 fugacious sepals and minute embryo near base of fleshy albumin; flowers large, in 2's or 4's; petals 4–12; stamens 16 +; ovary compound, 1-celled; anthers 2-celled, superior: fruit capsule; temperate climates; narcotic, emetic, cathartic, acrid poison.

Genus: **1. Papaver.**

OPIUM. OPIUM, *U.S.P.*

Papaver somniferum, *Linné,* and var. **album,** *DeCandolle.* — The air-dried, milky exudation obtained by incising the unripe capsules, yielding when moist, 9.5 p. c. of anhydrous morphine.

Habitat. W. Asia (Asia Minor, Persia), China, Africa, India, Italy, Greece, England, United States; cultivated.

Syn. Opium Poppy, White Poppy, Poppy, Maw (Black, Blue) Seed Poppy, Cheesebowl, Marble-flower; Meconium, Lachryma Papaveris, Succus Thebaicus, Opium Thebaicum, Thebaica; Fr. Opium de Smyrne—thebaicum, Pavot officinal; Ger. Opium, Mohnsaft.

Pa-pa'ver. See etymology, above, of Papaveraceæ.

Som-nif'er-um. L. *somnus,* sleep, + *ferre,* to bring—*i. e.*, produces sleep.

Al'bum. L. *albus,* white—*i. e.*, the flowers.

O'pi-um. L. fr. Gr. *ὄπιον,* poppy or vegetable juice.

Plants.—Erect annuals; stems .6–1.3 M. (2–4°) high, 12 Mm. (½′) thick, solid, smooth, glaucous, green, branched; roots yellow, thick, branched; leaves thick, ovate, cordate, variously toothed, sessile,

15–25 Cm. (6–10′) long, dull green, paler beneath, glaucous, prominent veins, white wide midrib; flowers, Feb.–March, few, large, 7.5–17.5 Cm. (3–7′) broad, terminal, silver-gray; sepals 2, green; petals 4, white (yellow, violet); stamens numerous; fruit capsule, 3–5–20 on each plant, nearly globular, 2.5–7.5 Cm. (1–3′) broad, filled with laticiferous vessels, flat top and bottom, smooth, glaucous neck; pericarp yellowish, dehiscing by small apertures beneath stigmatic crown; seed numerous, small, white (gray, violet, black). EXUDATION (opium), in more or less rounded, mostly somewhat flattened masses of variable size, usually 8–15 Cm. (3–6′) broad, dark brown, covered with fragments of poppy leaves and at times *Rumex* fruits, adhering from the packing; more or less plastic when fresh, becoming hard and brittle, or tough on keeping; internally dark brown, interspersed with lighter areas, somewhat lustrous; odor characteristic, narcotic; taste bitter, characteristic. *Solvents:* diluted alcohol; diluted acids; boiling water. Dose, gr. 1–2 (.06–.13 Gm.).

FIG. 145.—*Papaver somniferum:* 1, ovary with few remaining stamens; 2, ripened capsule; 3, seed; 4, longitudinal section of seed.

ADULTERATIONS. — Sand, stones, clay, ashes, shot, bullets, charcoal, gypsum, litharge; flour, starch, gums (acacia, tragacanth), sugar, molasses; aloe, pitch, resins, extract of capsules and herbs (papaver, lactuca, glycyrrhiza, chelidonium), pulp of apricots, fig, and grapes; camel's dung, pounded capsules, leaves, stems, moisture, exhausted opium.

Commercial. — Plant was known to the ancients, Homer mentioning it (poppy) as a medicine and as grown in gardens for strikingly ornamental flowers—a popularity still enjoyed. Seldom found wild as it requires rich soil and manure, timely rains, exact tillage and care until the yielding stage, being planted like our wheat, Sept.–Oct.—winter crop, or (when resowing is necessary through injury from absence of snow as a protection) Feb.–March—spring crop. Cultivation occasions great variability, the stronger, those having whitish petals and seed, and large capsules (var. *album*) degenerating into the weaker, those having pink, red, purple, blackish petals and seed, and small capsules (var. *nigrum*), and while all parts yield milk-juice the leaves and seed are without alkaloids, the former being used natively as spinach, the latter for the 50–60 p. c. of bland yellow oil—an acceptable substitute for olive oil in painting, cookery, pharmacy, etc. Opium is collected chiefly in Asia Minor, Egypt, India, etc., May–July, by

making into the unripe pale yellow or light green capsule, a few days after the flower falls, one or more transverse or spiral incisions (longitudinal in Japan, India) with a several bladed knife (nushtur), wetted occasionally with saliva or oil to prevent adherence—a second scarification frequently occurring 1–2 days later. The incisions, owing to laticiferous vessels lying just beneath the epidermis, must be only sufficiently deep to obtain all the juice (not through the inner capsular diaphragm which would cause its loss by escaping into the center of the capsule, as well as damage to seed and plant), and are made by men, women, and children in the afternoon, yielding at once the white exudation that soon concretes into tears and turns brown by next morning, when it is scraped off (often with 5–8 p. c. of capsular epidermis and other tissues—Smyrna) with a blunt knife onto a poppy or *Rumex* leaf held in the left hand; upon the mass becoming uncomfortably weighty the leaf margins are infolded, then further wrapped if necessary with fresh leaves and dried in the shade for several days, sufficient to avoid moldiness—a very common defect. At this stage collectors may simply press together the separate masses, when a lens easily reveals the agglutinated tears—*granular opium* (Asia Minor, Persia), or the tears may be reduced in a mortar to a uniform mass—*homogeneous opium* (Egypt, India), or the pure juice may be mixed with chopped vegetable tissues, or an aqueous extract of spent capsules and leaves, etc., to the extent of 33 p. c., often without disturbing the standard strength of morphine. Small growers dispose of their product to interior merchants, who, to prevent sticking, pack it with *Rumex* capsules in bags, which are sealed, placed in baskets, and forwarded to Smyrna, Constantinople, etc., where it is sold upon physical examination—color, odor, weight, consistence, and appearance affording usually a correct estimate—and transferred to the buyer's underground warehouse to prevent evaporation, or to further cure and manipulate. There are several varieties: 1, *Asia Minor* (*Turkey—P. somniferum*, + var. *album* and *gla'brum*): (*a*) Smyrna—most common in our market; in round, flat lumps, ½–2 pounds (.2–1 Kg.), tears like seed on inside, also capsular epidermis 5–8 p. c.—evidence of no manipulating, kneading; yield 10–13 p. c. of morphine; (*b*) Constantinople—resembles Smyrna in coming from the same northern opium districts of Anatolia, but without tears and capsular epidermis; in round, flat lumps, ½–3 pounds (.2–1.2 Kg.); yield 10–13 p. c. of morphine; extract 50 p. c.; from same port also comes the rich opiums of Gévé, Magnesia, Salonica, Bithynia, Amasia, Malatia, in packages 1–5 ounces (.03–.15 Kg.)—the Turkish "Adeth" (ordinary grade) yields usually 9.5 p. c. of morphine; 2, *Egyptian* (*P. somniferum*, + var. *glabrum*); in flat, roundish cakes, 2.5–15 Cm. (1–6′) broad, 2–16 ounces (.06–.5 Kg.), harder, redder, darker and less tenacious than the Smyrna, brittle, conchoidal fracture, waxy luster, no *Rumex* capsules; not much produced, seldom enters our market; yield 6–7 p. c. of morphine; 3, *Persian* (*Trebizond—P. somniferum*, + var. *album*); usually

wrapped in glossy paper having Chinese characters, tied with cotton thread and packed in poppy refuse, cylindrical sticks (resembling mint-candy), 7.5 Cm. (3′) long, 12 Mm. (½′) thick, ½–¾ ounce (15–23 Gm.), or short, rounded cones, balls 6–10 ounces (.18–.3 Kg.), or flat circular cakes, slightly agglutinated, liver-brown like Egyptian, soft in damp weather, very bitter, oily from linseed oil (instead of spittle) used on incising knives; more crystals than Asia Minor; largely doctored; exported to Europe, United States, but mostly to China; yield 8–12 p. c. of morphine; 4, *E. Indian;* wrapped in oiled paper or hard coating of leaves and poppy petals agglutinated with extract of the plant and juice—*Provision opium;* or molded into flat, square, circular cakes—*Abkari opium;* owing to moisture (dews) and delay in making up often ferments, yielding a hard brittle blackish product showing oily spots and conspicuous crystals; does not enter our market—consumed extensively in China; yield 5–7 p. c. of morphine—usually rich in narcotine, 3–4 p. c.; extract 70 p. c.; 5, *Chinese;* wrapped in white paper, flat darkish globular cakes, prepared no doubt by artificial heat, less oily than Persian, entirely consumed at home; annual production 40,000,000 pounds (18,181,800 Kg.), double the combined output of the other varieties, in addition to which the natives consume all of the Indian and much Persian in their vicious practices of smoking and chewing—now claimed to be largely on the decrease.

The once popular French (Aubergier's, *Affium*—14–23 p. c. of morphine) and Bulgarian (8–20 p. c. of morphine) are practically out of commerce. Opium has been introduced into Algeria and Mozambique (African) for Chinese trade, Bulgaria, Australia, New England, this latter being ruled from trade owing to excessive adulteration, but instead there has been manufactured in our country a "pudding"—so-called *Boston opium,* of high grade appearance but with admixtures reducing it so as just to come within the U.S.P. limit. Plants thrive in Europe and our Southern States (Virginia, S. Carolina, Georgia, Tennessee—hampered mainly by cost of labor), where during the Civil War much opium of high narcotic power was produced under cultivation, being planted in September and collected in May. *Factitious opium* is a blackish aqueous extract of the plant—nearly odorless and tasteless. London is the distributing point, as the English control its production and levy a tax upon its sale for the development of India, etc. Our entrepôts are New York and San Francisco.

Constituents.—Morphine (1816) 2.5–15–22.8 p. c., Narcotine (1803–1817) 1.3–10 p. c., Codeine (1832) .2–.7 p. c., Narceine (1832) .02–.1–.7 p. c., Pseudomorphine (1835) .2 p. c., Thebaine (1835) .15–1 p. c., Papaverine (1848) 1 p. c., and 12 other alkaloids, all combined with either sulphuric or meconic acid, 4 p. c.; derivatives—apomorphine, apocodeine, etc.; also contains glucose, mucilage, pectin, caoutchouc, wax, fat, resin, coloring and odorous principles, lactic acid (1.25 p. c.), meconin, $C_{10}H_{10}O_4$, meconoiosin, $C_8H_{10}O_2$, extractive, minerals 6 p. c., ash 6 p. c.

PAPAVERACEÆ

Morphina, Morphine, $C_{17}H_{19}O_3N.H_2O$.—This, the first alkaloid known, is obtained by exhausting opium with water, concentrating, filtering, adding alcohol, ammonia water, setting aside to crystallize, dissolving crystals in hot alcohol, treating with animal charcoal, crystallizing; or may treat concentrated filtered infusion with calcium chloride, evaporate filtrate, when morphine and codeine crystallize out, narcotine, etc., remaining in mother-liquors; occurs in colorless, or white shining rhombic prisms, or fine needles, or crystalline powder, odorless, bitter, permanent, soluble in water (3340), boiling water (1075), alcohol (210), boiling alcohol (98), chloroform (1220), ether (6250), lime water (100); insoluble in benzene; aqueous solution alkaline; forms numerous salts (acetate, hydrochloride, sulphate, etc.). *Tests:* 1. Add to .05 Gm. sulphuric acid 1 cc.—no color, reddish, yellowish; on heating changes to brown. 2. With sulphuric acid containing .005 Gm. of selenous acid in each cc.—blue color, changing to green, brown (codeine yields green color, changing to blue, grass-green; narcotine—green color, changing to brown, cherry-red); with sulphuric acid containing .005 Gm. of molybdic acid in each cc.—purple color, changing to blue; with sulphuric acid containing 1 drop of formaldehyde solution in each cc.—intense purple color. 3. With nitric acid—orange-red, fading to yellow. 4. With potassium ferricyanide T. S., + 1 drop ferric chloride T. S. + solution of salt (1 in 100)—deep blue at once (codeine slowly), with a few drops of ferric chloride T. S.—blue color, destroyed by acids, alcohol, heating; incinerate .5 Gm.—ash negligible. *Impurities:* Codeine, ammonium salts, foreign alkaloids, meconic acid, meconates, water. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Morphinæ Hydrochloridum, Morphine Hydrochloride, $C_{17}H_{19}O_3N.HCl.3H_2O$, *U.S.P.*—(Syn., Morph. Hydrochlor., Morphine Chloride, Morphinæ Hydrochloras, Morphinæ Murias; Fr. Chlorhydrate de Morphine; Ger. Morphinum hydrochloricum, Morphinhydrochlorid, Salzsaures Morphin.) Obtained by mixing morphine with boiling distilled water, adding diluted hydrochloric acid until dissolved and neutral, concentrating until crystals appear; occurs in white, silky, glistening needles, cubical masses, or as a white, crystalline powder, odorless, bitter, permanent, soluble in water (17.5), boiling water (.5), alcohol (52), hot alcohol (46), glycerin; insoluble in chloroform, ether; aqueous solution neutral, slightly acid. *Tests:* 1. Aqueous solution + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Dry to constant weight—loses not more than 15 p. c. (abs. of water). 3. Aqueous solution 5 cc., + potassium carbonate T. S. 2 cc., shake—white precipitate, not green on exposure, nor colors chloroform when shaken with it (abs. of apomorphine). *Impurities:* Apomorphine, water, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Morphinæ Sulphas, Morphine Sulphate, $(C_{17}H_{19}O_3N).H_2SO.5H_2O$, *U.S.P.*—(Syn., Morph. Sulph., Morphiæ Sulphas, Sulphas (Sulfas)

Morphicus; Fr. Sulfate de Morphine; Ger. Morphinum sulfuricum, Morphinsulfat, Schwefelsaures Morphin.) Obtained by mixing morphine (1) with boiling water (2), adding diluted sulphuric acid until dissolved and neutral, setting aside to crystallize; occurs in white, feathery, silky crystals, or cubical masses, or white crystalline powder, odorless, bitter, permanent, soluble in water (15.5), hot water (.7), alcohol (565), hot alcohol (240); insoluble in chloroform, ether; aqueous solution (1 in 20) neutral, slightly acid. *Tests:* 1. Aqueous solution (1 in 30), + few drops ammonia T. S., shake—white precipitate, dissolving in sodium hydroxide T. S. 2. With sulphuric acid containing .005 Gm. of selenous acid in each cc.—blue, green, brown; codeine—green, blue, grass-green; dry to constant weight—loses not more than 12 p. c. (abs. of water). 3. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Codeine, ammonium salts, meconate, water. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Æthylmorphinæ Hydrochloridum, Ethylmorphine Hydrochloride, $C_{17}H_{18}O_2N(OC_2H_5.HCl.2H_2O$, *U.S.P.*—(Syn., Æthylmorph. Hydrochl., Ethylmorphine Chloride, Dionin; Fr. Chlorhydrate d'ethylmorphine; Ger. Salzsaure Morphinæthylæther.) This hydrochloride of a synthetic alkaloid prepared from morphine by ethylation is obtained by the action of ethyl iodide on morphine dissolved in sodium or potassium hydroxide solution, forming ethyl morphine (codethyline) and alkali, the former being insoluble in excess of alkali; purify by crystallizing from hot alcohol, dissolve in hot water, neutralize with hydrochloric acid, crystallize. It is a white, yellowish, odorless, microcrystalline powder, soluble in water (8), alcohol (22), slightly in ether, chloroform; aqueous solution neutral; melts at 123° C. (254° F.) with decomposition. *Tests:* 1. Dissolve .01 Gm. in 10 cc. of sulphuric acid, + a drop of ferric chloride T. S., warm, + a drop of nitric acid—green, then deep violet-blue, turning deep red. 2. Aqueous solution (1 in 20) + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 3. Incinerate .2 Gm.—ash negligible. *Impurities:* Ammonium compounds, morphine, codeine hydrochloride. Produces no constipation, nausea, lassitude, tolerance, otherwise similar to morphine—for pain, cough, etc. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.), tablet, suppository; externally 10–20 p. c. solutions.

Apomorphinæ Hydrochloridum, Apomorphine Hydrochloride, $C_{17}H_{17}O_2NHCl.\frac{1}{2}H_2O$, *U.S.P.*—(Syn., Apomorph. Hydrochl., Apomorphine Chloride, Apomorphinæ Hydrochloras; Fr. Chlorhydrate d'Apomorphine; Ger. Apomorphinum hydrochloricum, Apomorphinhydrochlorid.) This hydrochloride of the artificial alkaloid is prepared from morphine (abstracting 1 molecule of water) by heating morphine or codeine (1) with pure hydrochloric acid (20) in a sealed glass tube 2–3 hours at 149° C. (300° F.), cooling liquid contents, adding excess of sodium bicarbonate to precipitate apomorphine, treating precipitate with ether or chloroform, adding a little hydrochloric acid,

when crystals form; it occurs in minute, grayish-white, glistening, crystals, odorless, slightly bitter taste, greenish upon exposure, soluble in water (50), hot water (17), alcohol (50), slightly in chloroform, ether; aqueous solution neutral; over sulphuric acid loses water of crystallization, regaining it on exposure. *Tests:* 1. Aqueous solution (1 in 100) + sodium bicarbonate solution—white, greenish-white precipitate, green on exposure, dissolving in ether (violet), chloroform (violet-blue). 2. Shake .1 Gm. + ether 5 cc.—not more than pale reddish color (abs. of decomposition products). 3. Aqueous solution + silver nitrate T. S.—white precipitate, insoluble in nitric acid, black by reduction to metallic silver—instantly reduced by ammonia water. 4. Incinerate .2 Gm.—ash negligible; salt dissolves in nitric acid—purple. *Impurities:* Decomposition products. Should be kept dark, in small, well-stoppered vials, having been rinsed with diluted hydrochloric acid and dried; should be rejected if shaking with water (100) produces at once an emerald-green; solutions should be made freshly with a little hydrochloric or acetic acid to prevent decomposition. Dose, expectorant, gr. $\frac{1}{40}$—$\frac{1}{25}$ (.0015–.0025 Gm.); emetic, gr. $\frac{1}{16}$—$\frac{1}{8}$ (.004–.008 Gm.).

Diacetylmorphine, Diamorphine, Heroin(e), $C_{17}H_{17}ON(C_2H_3O_2)_2$. and its soluble salt: *Diacetylmorphine Hydrochloride*, both U.S.P. 1910, are prepared from morphine by acetylization—heating morphine with acetyl chloride, washing product with water, then with dilute solution of sodium carbonate, purifying by crystallization from hot alcohol. They are white crystalline powders; odorless and bitter; soluble in water (1700), salt (2). Dose, gr. $\frac{1}{24}$—$\frac{1}{12}$ (.0025–.005 Gm.), 3–4 times daily, 2 p. c. solution (salt) hypodermically.

Codeina, Codeine, $C_{17}H_{18}(CH_3)O_3N.H_2O$, *U.S.P.*—(Syn., Codein., Codeia, Methylmorphine; Fr. Codeine; Ger. Codeïnum, Kodein, Codein.) Obtained from opium by precipitating infusion with chalk and calcium chloride, when chlorides of morphine and codeine crystallize out; dissolve these in water, add ammonia, when morphine crystallizes, evaporate filtrate for codeine; if instead of ammonia we use potassium or sodium hydroxide, codeine will be precipitated and morphine remain in solution; may obtain it also synthetically from morphine by methylation—acting upon alkaline solution of morphine with methyl iodide or chloride, or sodium methylsulphate, hence it is methylmorphine. It is in colorless, translucent crystals, crystalline powder; odorless, slightly efflorescent in warm air, soluble in water (120), alcohol (2), warm alcohol (1.2), chloroform (.5), ether (18), benzene (13); aqueous solution alkaline, levorotatory; when anhydrous melts at 155° C. (311° F.); heated with insufficient water to dissolve melts to oily drops, crystallizing on cooling. *Tests:* 1. With sulphuric acid containing .005 Gm. of selenous acid in each cc.—green, rapidly blue, slowly to green. 2. Dissolve .01 Gm. in sulphuric acid 5 cc.—transient pink, + a drop of ferric chloride T. S.—blue when warmed, changing to red with a drop of nitric acid; dry to constant weight—

loses not more than 6 p. c. (abs. of water); incinerate .5 Gm.—ash negligible. *Impurities:* Morphine, readily carbonizable substances, water. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Codeinæ Phosphas, Codeine Phosphate, $C_{17}H_{18}(CH_3)O_3N.H_3PO_4.2H_2O$, *U.S.P.*—(Syn., Codein. Phos.; Fr. Phosphate de Codéine; Ger. Codeïnum phosphoricum, Kodeinphosphate.) Obtained by dissolving codeine (10) in 25 p. c. phosphoric acid (12.5), leaving solution slightly acid, and adding alcohol sufficient to precipitate. It is in fine, white, needle-shaped crystals, crystalline powder; odorless, very efflorescent, soluble in water (2.3), hot water (.5), alcohol (325), boiling alcohol (125), chloroform (4500), ether (1875); aqueous solution acid. *Tests:* 1. Aqueous solution neutralizing with ammonia water, + silver nitrate T. S.—yellow precipitate, soluble in diluted nitric acid or ammonia water. *Impurities:* Chlorides, sulphates. Considered the best salt for hypodermic use, as it is more soluble and less irritating. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.); injection, gr. $\frac{1}{3}$–$\frac{3}{4}$ (.02–.05 Gm.).

Codeinæ Sulphas, Codeine Sulphate, $[C_{17}H_{18}(CH_3)O_3N]_2H_2SO_4.5H_2O$, *U.S.P.*—(Syn., Codein. Sulph.; Fr. Sulfate de Codéine; Ger. Codeïnum sulfuricum, Kodeinsulfat.) Obtained by dissolving codeine 100 Gm. in warm water, adding sufficient sulphuric acid (16.54 Gm.) to get neutral liquid, concentrating, allowing to crystallize. It is in long, glistening, white, needle-shaped crystals, rhombic prisms, crystalline powder; odorless, efflorescent, soluble in water (30), hot water (6.5), alcohol (1280), warm alcohol (440), insoluble in chloroform, ether; aqueous solution faintly acid. *Tests:* 1. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Dry to constant weight—loses not more than 12 p. c. (abs. of water). *Impurities:* Morphine, readily carbonizable substances, water. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Narcotine, $C_{22}H_{23}O_7N$.—Obtained from an aqueous solution by shaking, or from opium itself by macerating with ether or chloroform; occurs in tasteless, colorless, shining, rhombic crystals; soluble in ether, chloroform, benzene, hot alkaline solutions; dissolves blood-red in sulphuric acid containing some nitric acid; heated with nitric acid gives meconin, $C_{10}H_{10}O_4$, cotarnine, $C_{12}H_{13}NO_3$, and opianic acid, $C_{10}H_{10}O_5$; forms salts (hydrochloride, sulphate, etc.). Dose, gr. 1–3 (.06–.2 Gm.).

Cotarninæ Chloridum, Cotarnine Chloride, $C_{12}H_{14}O_3NCl.H_2O$, *U.S.P.*—(Syn., Cotarn. Chlor., Cotarninæ Hydrochloridum, Stypticin; Fr. Chlorhydrate de Cotarnine; Ger. Cotarninhydrochlorid.) This quaternary oxymethyl-oxymethylene-dihydro-isoquinoline chloride is an oxidation product, similar to hydrastinine, obtained by hydrolyzing narcotine—boiling it with water for a long time, or heating with diluted nitric acid, precipitating with potassium hydroxide solution, dissolving the resulting cotarnine in diluted hydrochloric acid, crystallizing. It is a yellow crystalline powder, odorless, bitter,

deliquescent in moist air, very soluble in water, alcohol (yellow solutions); aqueous solution neutral. *Tests:* 1. Aqueous solution, + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Dissolve .2 Gm. in 10 cc. of distilled water, + 10 cc. of $\frac{N}{10}$ iodine V. S.—brown precipitate (cotarnine periodide), which, when dried, melts at 143° C. (290° F.). 3. Heat gradually .1 Gm.—decomposes, evolving characteristic, disagreeable vapors and yielding a reddish-brown liquid, changing to hard charred mass; incinerate mass—ash negligible. 4. Dissolve .5 Gm. in 10 cc. of distilled water, add 2 cc. of aqueous solution of sodium hydroxide (15 p. c.)—milk-white precipitate, dissolved on agitation, reprecipitated on standing. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.), 4–5 times daily, in coated tablet, pill, capsule; hypodermic, ♏30 (2 cc.) of 10 p. c. solution; externally, pure or strong solution. Cotarnine Phthalate, Styptol, $(C_{12}H_{13}O_3N)_2C_6H_4(CO_2H)_2$—similar to the official salt, Cotarnine Chloride; hemostatic, sedative—uterine hemorrhage. Dose, gr. $\frac{1}{2}$–1 (.03–.06 Gm.), 4–5 times daily.

Narceine, $C_{23}H_{29}O_9N$.—Long, silky needles, bitter, sparingly soluble in cold alcohol and water, insoluble in ether; with warm diluted sulphuric acid—violet and cherry-red; with nitric acid—transiently yellow; with iodine—blue; with Fröhde's reagent—brown-yellow; forms salts (hydrochloride, nitrate, sulphate, etc.). Dose, gr. $\frac{1}{3}$–$\frac{3}{4}$ (.02–.05 Gm.).

The four alkaloids, morphine, codeine, narcotine, and narceine, may be extracted from any given sample of opium by shaking the concentrated infusion with ether—taking out narcotine; adding alkali in excess to filtrate—redissolving morphine and narceine, leaving codeine deposited; allowing morphine to crystallize from filtrate, and having narceine in mother-liquor, to be obtained by evaporation.

Meconic Acid, $C_7H_4O_7$.—Occurs free and in combination with the alkaloids, being obtained by adding calcium chloride to concentrated infusion of opium, decomposing the resulting calcium meconate with warm dilute hydrochloric acid and recrystallizing from water. *Tests:* 1. With ferric chloride T. S.—blood-red color, not discharged by dilute hydrochloric acid (dif. from acetic and formic acids), or by chlorides of gold or mercury (dif. from sulphocyanates).

Deodorized, granulated, and powdered opiums of a higher grade may be reduced with a lower, or with an inert diluent, to the required strength; or a proportionately less quantity of the higher percentage may be used direct in making preparations; thus of 15 p. c. opium only $66\frac{2}{3}$ Gm. need be employed where the U.S.P. directs 100 Gm.—$15 : 10 :: 100 : x$, or $x = 66.67$.

PREPARATIONS.—I. OPIUM: 1. *Opium Granulatum.* Granulated Opium. (Syn., Opium Gran.; Fr. Opium Grenelé; Ger. Granulirtes Opium.)

Manufacture: Dry opium, convenient quantity, at 70 °C. (158° F.), reduce it to a coarse (No. 8–20) powder; contains 10–10.5 p. c. of anhydrous morphine. Should be kept in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Preps.: 1. *Tinctura Opii.* Tincture of Opium. (Syn., Tr. Opii, Laudanum, Tinctura Opii Deodorati, Tincture of Deodorized Opium, U.S.P. 1910; Tinctura (Meconii) Thebaica; Fr. Teinture d'Opium (de Extrait d'Opium)—thébaique; Ger. Tinctura Opii Simplex, Einfache Opiumtinktur.)

Manufacture: 10 p. c. Pour boiling water 50 cc. on granulated opium 10 Gm. in a suitable vessel, and stir frequently during 24 hours, percolate until exhausted. Concentrate to 15 cc., add paraffin 5 Gm., and continue heat until entirely melted, beat mixture thoroughly, cool; pierce paraffin, drain off liquid, add water 60 cc., filter; to filtrate add alcohol 20 cc.; wash paraffin and filter with water q. s. for 95 cc.; assay, add 20 p. c. alcohol q. s. for 100 cc. tincture to contain .95–1.05—1. Gm. of anhydrous morphine. Dose, ♏v–20 (.3–1.3 cc.).

Preps.: 1. *Linimentum Opii Compositum, N.F.,* 10 p. c. 2. *Lotio Plumbi et Opii, N.F.,* 3.5 p. c. 3. *Mistura Carminativa, N.F.,* 2.5 p. c. 4. *Mistura Copaibæ et Opii, N.F.,* 3.2 p. c. 5. *Mistura Magnesiæ, Asafœtidæ et Opii, N.F.,* 1 p. c. 6. *Mistura Opii et Chloroformi Composita, N.F.,* 20 p. c. 7. *Mistura Opii et Rhei Composita, N.F.,* 20 p. c. 8. *Tinctura Ipecacuanhæ et Opii, N.F.,* āā 10 p. c. (diluted alcohol). Dose, ♏v–20 (.3–1.3 cc.). 9. *Tinctura Opii et Gambir Composita, N.F.,* 4.2 p. c.

2. *Tinctura Opii Crocata, N.F.,* 10 p. c.

2. *Opium Pulveratum.* Powdered Opium. (Syn., Opium Pulv., Opii Pulvis, U.S.P. 1910; Fr. Poudre d'Opium; Ger. Opium pulveratum, Opiumpulver.)

Manufacture: Dry opium, convenient quantity, at 70 °C. (158° F.), reduce it to a very fine powder; contains 10–10.5 p. c. of anhydrous morphine. It is light brown; microscopically—chiefly yellowish-brown, brownish-red, irregular and granular fragments, .015–.15 Mm. ($\frac{1}{1650}$—$\frac{1}{165}$′) broad, few fragments of strongly lignified, thick-walled, 4–5-sided or narrowly elongated epidermal cells of poppy capsules, also tissues of poppy leaves, capsules and rumex fruits. Should be kept in well-closed containers. Dose, gr. 1-2 (.06–.13 Gm.).

Preps.: 1. *Pulvis Ipecacuanhæ et Opii.* Powder of Ipecac and Opium. (Syn., Pulv. Ipecac. et Opii., Compound Powder of Ipecac, Dover's Powder; Br. Pulvis Ipecacuanhæ Compositus; Fr. Poudre d'Ipécacuanha opiacée—de Dover; Ger. Pulvis Ipecacuanhæ opiatus, Doversches Pulver, Pulvis Doveri.)

Manufacture: 10 p. c. Triturate together ipecac 10 Gm., powdered opium 10 Gm., lactose 80 Gm.; reduce to a very fine, uniform powder. It is grayish-white, light brown; exhibiting coarse angular, cone-shaped fragments soluble in water or chloral hydrate T. S., strongly polarizing light with display of colors (lactose), numerous tracheids and starch grains of ipecac, .015–.02 Mm, ($\frac{1}{1665}$—$\frac{1}{1250}$′) broad, calcium oxalate

raphides up to .05 Mm. ($\frac{1}{500}'$) long, stone cells of opium (poppy) capsules. Dose, gr. 5–10 (.3–.6 Gm.).

2. *Tinctura Opii Camphorata.* Camphorated Tincture of Opium. (Syn., Tr. Opii Camph., Paregoric, Paregoric Elixir; Br. Tinctura Camphoræ Composita, Compound Tincture of Camphor; Fr. Élixir Parégorique—d'Opium Benzoïque, Teinture d'Opium camphrée; Ger. Tinctura Opii benzoïca, Benzoësaürehaltige Opiumtinktur.)

Manufacture: $\frac{2}{5}$ p. c. Similar to Tinctura Cardamomi Composita, page 137—macerating powdered opium .4 Gm., benzoic acid .4, camphor .4, oil of anise .4 cc., in glycerin 4 cc., diluted alcohol 95 cc., finishing with diluted alcohol q. s. 100 cc. Dose, ℥ss–2 (2–8 cc.).

Preps.: 1. *Mistura Glycyrrhizæ Composita,* 12 p. c. 2. *Mistura Pectoralis, N.F.,* 17.5 p. c.

3. *Pilulæ Opii, Digitalis et Quininæ, N.F.,* $\frac{1}{6}$ gr. 4. *Pilulæ Opii et Camphoræ, N.F.,* 1 gr. 5. *Pilulæ Opii et Plumbi, N.F.,* 1 gr. 6. *Pulvis Cretæ et Opii Aromaticus, N.F.,* 2.5 p. c.

3. *Extractum Opii, N.F.*—Yields 19.5–20.5 of anhydrous morphine; 1 Gm. represents about 2 Gm. of opium.

II. Alkaloids: 1. *Elixir Terpini Hydratis et Codeinæ, N.F.,* codeine $\frac{1}{5}$ p. c. 2. *Mistura Chloroformi et Morphinæ Composita, N.F.,* morphine sulphate $\frac{1}{4}$ p. c. 3. *Syrupus Pini Albæ Compositus cum Morphina, N.F.,* morphine sulphate $\frac{1}{25}$ p. c.

Unoff. Preps.: Extractum Opii Liquidum (Br., 3.75 p. c. of extract). *Linimentum Opii* (Br. 50 p. c. of tincture). *Pills,* 1 gr. (0.6 Gm.), dose, 1–2. *Plaster. Pulvis Opii Compositus* (Br., 10 p. c.). *Tinctura Opii Ammoniata* (Br., 10 p. c. of tincture). *Troches of Glycyrrhiza and Opium,* $\frac{1}{13}$ gr. (.005 Gm.). *Vinegar* (Black Drop), 10 p. c., ♏v–20 (.3–1.3 cc. *Wine,* 10 p. c., ♏v–20 (.3–1.3 cc.). *Chlorodyne* (morphine hydrochloride .5 Gm., water 2 cc, diluted hydrochloric acid 2, chloroform 6, tincture of cannabis 4, diluted hydrocyanic acid 1, alcohol 16, oil of peppermint 1, oleoresin of capsicum .05, ♏v–15 (.3–1 cc.), in water—poisonous. *Compound Powder of Morphine* (Tully's Powder, 1.5 p. c., gr. v–10 (.3–.6 Gm.). *Injectio Apomorphinæ Hypodermica* (Br.), 1 p. c. *Injectio Morphinæ Hypodermica* (Br.), 2.5 p. c. *Liquor Morphinæ Sulphatis* (U. S. P. 1870, $\frac{1}{4}$ p. c., ℥j–2 (4–8 cc.). *Liquor Morphinæ Acetatis* (Br.), 1 p. c. *Liquor Morphinæ Hydrochloridi* (Br.), 1 p. c. *Liquor Morphinæ Tartratis* (Br.), 1 p. c. *Majendie's Solution of Morphine,* 4 p. c. (adding $\frac{2}{3}$ p. c. of benzoic acid or phenol prevents spoiling and hypodermic irritation), ♏v–10 (.3–.6 cc.). *Oleate of Morphine,* 10 p. c. (oleic acid 90 p. c.)—use externally. *Suppositoria Morphinæ* (Br.), $\frac{1}{4}$ gr. (.017 Gm.). *Syrupus Codeinæ Phosphatis* (Br.), .5 p. c. *Troches of Morphine and Ipecac,* $\frac{1}{40}$ gr. (.0016 Gm.) + ipecac $\frac{1}{13}$ gr. (.005 Gm.). *Trochiscus Morphinæ* (Br.), $\frac{1}{32}$ gr. (.002 Gm.).

Properties.—Narcotic, sedative, anodyne, antispasmodic, hypnotic, diaphoretic, chiefly due to morphine. Codeine—hypnotic,

tetanic, less constipating and active than morphine, often contaminated with other alkaloids; used for bronchial coughs, diabetes, etc. Narcotine—antiperiodic, tetanizing, hypnotic without being narcotic, hence name should have been anarcotine. Narceine resembles morphine, but is more hypnotic, with less after-effects—headache, constipation, etc. Apomorphine—stimulant to brain (vomiting) centers, heart; our most useful emetic (hypodermically) in narcotic poisoning, removing foreign bodies from bronchi, etc., sedative expectorant; large amounts depress, produce tetanic convulsions. Diacetylmorphine—sedative, respiratory depressant, slows and deepens respiration more than morphine and develops its habit, neither analgesic or hypnotic, nor does it stupify or constipate; excessive cough, postoperative pain, uremic dyspnea, catarrhal coughs, phthisis, angina, bronchitis, asthma, whooping-cough, hay fever. *Poisoning:* Syncope, suppressed vision, myosis, abnormal temperature have been produced by gr. 3 (.2 Gm.)—antagonize by hypodermic camphor, caffeine, and hot coffee by stomach. Cotarnine—hemostatic, analgesic, uterine sedative, styptic; dysmenorrhea, hemorrhages (bladder, nose, extraction of teeth, etc.), menorrhagia, etc. Thebaine (paramorphine)—soporific, spinal excitant, tetanizer, resembling strychnine. Dose, gr. $\frac{1}{2}$–$\frac{3}{4}$ (.03–.05 Gm.). Papaverine—hypnotic, sedative; diarrhea of children. Dose, gr. $\frac{1}{1\,2}$–$\frac{1}{2}$ (.005–.03 Gm.).

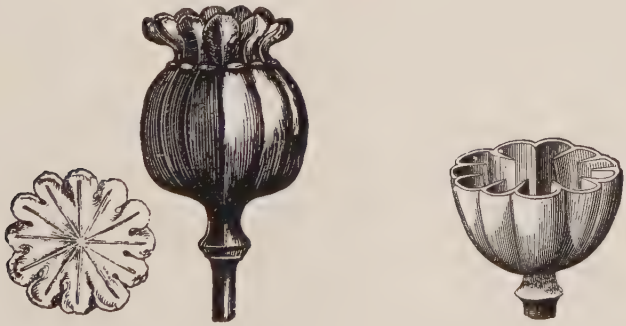


Fig. 146.—Poppy capsule, showing internal septa.

Opium in full doses, gr. 1–3 (.06–.2 Gm.), produces dry mouth, thirst, stimulates brain by increasing blood supply, arrests digestion by reducing bile, gastric and pancreatic juice secretion; causes nausea, vomiting, sweating, depressed circulation and respiration, lower temperature, contracted pupil, retention of urine, profound sopor, or, instead, coma-vigil and delirium with delightful dreams. After-effects are nausea, depression, constipation, headache, vertigo, nasal pruritus.

Uses.—To relieve pain, except in acute inflammation of the brain; to cause sleep in insomnia of low fevers; to allay irritation, to check secretions—diarrhea, dysentery, diabetes; to support system in low fevers, etc.; also for peritonitis, cerebrospinal meningitis, cholera mor-

bus, delirium tremens, mania spasms, melancholia, sciatica, neuralgia, cancer, renal and hepatic colic from calculi, cough without secretion; to lock bowels when required by inflammation, hemorrhages, dyspnea, angina pectoris, cerebral anemia; morphine hypodermically for consumption, chronic catarrh, asthma, diabetes, typhoid fever, dysenteric tenesmus, epilepsy, hysteria, croup, bronchitis, dysmenorrhea. Externally opium applied in poultices for gout, rheumatism, ophthalmia, odontalgia, periodontitis, inflamed gums and mucous membrane of mouth. Young children are very susceptible to its narcotic effects, to whom it should be given cautiously, women are affected much easier than men, and some individuals possess idiosyncrasy toward it, being on the one hand easily, on the other with difficulty, brought under its influence; others cannot tolerate the smallest dose, while many animals accept it *ad libitum*—ducks, chickens, pigeons, monkeys, etc.

Poisoning: Have mental excitement, increased heart action, slow, irregular, stertorous breathing, cold, clammy sweats, headache, deep sleep, contracted pupils, face reddened, then bluish, slow pulse and dilated pupils as the end approaches, lost reflexes; jaw falls, muscular relaxation, coma, death finally by paralyzed respiration; the more contracted the pupils, the more serious, while vomiting and free perspiration are favorable symptoms. In apoplexy pupils are unequal, in alcoholism they are normal or dilated, in chloroform widely dilated; the odor of breath and vomited matter will often aid diagnosis. Give tannic acid or vegetable astringents (strong coffee or tea), then evacuate the stomach (pump, apomorphine, zinc sulphate, ipecac, etc.), or wash it out with a warm solution of potassium permanganate (using twice the amount of salt as of morphine ingested), then atropine (strychnine), caffeine, cocaine, digitalis, brandy, spirit of nitrous ether, amyl nitrite) to maintain circulation and respiration; faradization, cold douches, ambulation, flagellation; it is eliminated by the kidneys, consequently catheterize the bladder often to prevent reabsorption, and keep the patient awake.

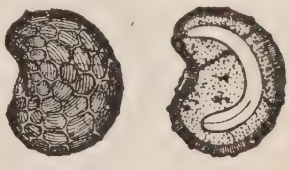
Incompatibles: Alkalies, alkaline carbonates, lime water, tannic acid and vegetable preparations containing it, salts of lead, iron, copper, mercury, and zinc, Fowler's solution, atropine, strychnine, coffee, caffeine, tartar emetic, digitalis; with morphine: iodine, iodides, bromine, bromides, sodium borate.

Synergists: Alcohol, chloral hydrate, belladonna, cocaine, ipecac.

Opium-habit (Disease): To this, thousands of weak and strong-minded have fallen prey, including such eminent characters as Coleridge, Robert Hall, John Randolph, De Quincey, Wilkie Collins, etc. By some thought to be a habit, which may be cured by gradually lessening the quantity or by stopping off abruptly, substituting for a time tonics, hyoscine and stimulants—ginger, capsicum, black pepper, quassia, calumba, diluted phosphoric acid, tincture lupulin, etc. Others consider it a disease amenable to systematic systemic treat-

ment in hospitals, etc., where mainly hygiene, tonics, strychnine, atropine, quinine, iron and gold salts are relied upon. Decoction of Sumatra climber, *Combre'tum sunda'icum*, is claimed to be valuable.

Opium-test: Heat the gum, which, becoming fluid, runs when tilted from dung, mineral and vegetable matters, evaporate heavy liquid to a powder; of this take 25 gr. (1.6 Gm.) + water ℥iv (15 cc.), triturate, if stiff or mucilaginous—starch, flour, gum, salep; add water ℥ij (60 cc.), filtrate should be wine-yellow—no extract glycyrrhiza; mixture should be acid—no ashes, chalk, litharge; evaporate to ℥j (30 cc.), add potassium ferrocyanide or twice quantity alcohol, should get no precipitate—no heavy metal or gums; the insoluble residue should be 10–11.5 gr. (.6–.7 Gm.), or 100 parts should yield 55–60 parts of aqueous extract.



a *b*

Fig. 147.—Poppy seed, magnified 12 times: *a*, the outside; *b*, longitudinal section showing embryo.

Allied Products:

1. *Papaveris Capsulæ, Poppy Capsules, Papaver, Poppy.*—The nearly ripe capsules, U.S.P. 1840–1870. These are collected in August–September, when nearly ripe, inverted to keep the juice from escaping, and dried in kilns for about 12 hours; from these, deprived of seed, may make an extract and syrup, and, including the seed, a decoction. Capsules or heads are the size of a hen's egg to one's fist, and contain morphine .2–2 p. c.; syrup (syrupus papaveris), 10 p. c.—coughs, etc.; decoction—demulcent to sprains, bruises, etc.

Fig. 148.—*Papaver Rhœas.*

2. *Seed.*—When black called *maw* seed; not narcotic, yield 40–60 p. c. fixed oil, which is used as food, for burning in lamps, by painters, instead of olive oil; expressed (oil) cake for cattle, seed for birds.

3. *Exhausted gum.*—For poultices as anodyne applications.

Allied Plants:

1. *Papaver Rhœ'as, Rhœados Petala, Red Poppy Petals* Br.).—Europe; flowers large, beautiful red, petals mainly used for their coloring matter, which is yielded to water; its milky juice is sedative, demulcent, mild anodyne, probably due to *rhœadine*, also contains two coloring principles—rhœadic and papaveric acids. Syrupus Rhœados (Br.), 26 p. c. Dose, ℥ss–1 (2–4 cc.).

2. *Sanguina'ria canaden'sis, Sanguinaria, Blood Root, N.F.*—The dried rhizome and roots with not more than 2 p. c. of foreign organic matter; N. America. Perennial herb, in early spring puts forth a rounded palmate 5–9-lobed leaf and a slender scape 10–20 Cm. (4–8′)

high, bearing a large, single white flower; fruit, June, capsule (pod), oblong, many-seeded. Rhizome horizontal, occasionally branched, subcylindrical, flattened, 2–7 Cm. ($\frac{4}{5}$–3′) long, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) thick, dark brown, slightly annulate, few stem-scars, many broken filiform roots; odor slight; taste persistently acrid and bitter. Powder, brownish-red, sternutatory — numerous starch grains resembling those of wheat, latex cells with brownish resin masses, few tracheal fragments; solvents: alcohol, diluted acetic acid, water; contains chelerythrine, sanguinarine, protopine, β-homochelidonine, resin, starch, ash 8 p. c. Systemic emetic, stimulating expectorant, sialagogue, alterative, tonic, acro-narcotic poison; chronic bronchitis, croup, asthma, gastro-intestinal catarrh, jaundice, dyspepsia, torpid liver. *Poisoning:* Wash out the stomach, give diffusible stimulants, amyl nitrite, morphine, atropine. Dose, expectorant, gr. 1–8 (.06–.5 Gm.); emetic, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Sanguinariæ* (1st menstruum: hydrochloric acid

Fig. 149.—*Sanguinaria canadensis.*

Fig. 150.—Sanguinaria rhizome, showing cross-section.

5 cc., water 20, alcohol 75, 2d: 75 p. c. alcohol); 2. *Tinctura Sanguinariæ*, 10 p. c., dose, ♏v–60—℥j–2 (.3–4;—4–8 cc.); 3. *Syrupus Pini Albæ Compositus*, $\frac{4}{5}$ p. c. *Acetum*, 10 p. c.; *Infusion*, 5 p. c., ℥ss–4 (15–120 cc.).

3. *Chelido'nium ma'jus, Chelidonium, Celandine.*—The entire plant, collected when beginning to flower, U.S.P. 1880–1890; Europe, N.

America. Perennial light green plant, .6 M. (2°) high, emitting when wounded a saffron-yellow, opaque juice; leaves pinnate, 10–20 Cm. (4–8′) long; flowers yellowish; root reddish-brown, several-headed, branching; fruit capsule, linear, 2-valved; seed numerous; odor unpleasant when fresh; taste acrid; contains chelerythrine, chelidonine, α- and β-homochelidonine, chelidoxanthin, sanguinarine, protopine, chelidonic (jervic) acid, chelidoninic (ethylenesuccinic) acid, gum, chlorophyll; solvents: water, alcohol. Cathartic, diuretic, diaphoretic, expectorant; used by ancients as now for jaundice, dropsy, intermittent fever, scrofula, skin diseases; externally—warts, corns, eczema, urticaria, itching eruptions; fresh herb in amenorrhea, as a vulnerary. Dose, dried plant, gr. 15–60 (1–4 Gm.); fresh plant, ʒj–2 (4–8 Gm.).

4. *Dicen'tra canaden'sis* or *D. Cuculla'ria, Corydalis, Turkey (Squirrel) Corn, N.F.*—The dried tubers with not more than 3 p. c. of foreign organic matter; N. America, Canada to Ky. Low glaucous perennial herb, leaves dissected, scapes several, each with 4 greenish-white, purple-tinged flowers. Tubers spheroidal, ovoid, 10–15 Mm. ($\frac{2}{5}$–$\frac{3}{5}$′) thick, single, clusters 2–3, smooth or pitted, grayish-brown, translucent; fracture hard, horny, whitish, waxy interior, or granular and tough; nearly odorless; taste bitter. Powder, yellowish—numerous starch grains, few tracheæ, stone cells, few calcium oxalate rosette crystals; contains corydaline, fumaric acid, bitter extractive, resin, starch. Tonic, diuretic, alterative; syphilitic, scrofulous and cutaneous affections. Dose, gr. 10–30 (.6–2 Gm.); 1. *Fluidextractum Corydalis* (75 p. c. alcohol): Prep.: 1. *Elixir Corydalis Compositum*, fldext. 6 p. c., + fldexts. stillingia 6, xanthoxylum 3, blue flag 9, potassium iodide 5, dose, ʒj–2 (4–8 cc.). 2. *Fluidextractum Stillingiæ Compositum*, 25 p. c.

Fig. 151.—*Chelidonium majus:* showing fruit, flowers, ovary, and seed.

5. *Glau'cium Glaucium (lu'teum), Yellow Horned Poppy*, and *G. cornicula'tum.*—Both are similar to chelidonium; contain yellow juice and nearly identical alkaloids, hence used for about the same purposes.

6. *Argemo'ne mexica'na, Prickly Poppy.*—Capsules and leaves contain berberine, protopine (macleyine, fumarine), but no morphine; seed have a bland, light yellow fixed oil 36 p. c.; substitute for castor oil. Dose, ♏xv–45 (1–3 cc.).

27. CRUCIFERÆ. Mustard Family.

Kru-sif′e-re. L. *Crucifer*, fem. pl. fr. *cru(x)c*, a cross, + *ferre*, to bear—*i. e.*, flowers (petals) arranged in shape of maltese cross. Herbs,

CRUCIFERÆ

shrubs. Distinguished by pungency or acrid juice, cruciform flowers, tetradynamous stamens, fruit a silique or silicle, 2-celled; sepals 4; petals 4; stamens 6, of which 2 are shorter and inserted lower down; pistil 1, compound, superior; seeds albuminous; temperate, frigid, and tropical climates; antiscorbutic, pungent, acrid (fixed and volatile oils).

Genus: **1. Brassica.**

SINAPIS NIGRA. BLACK MUSTARD, *U.S.P.*

Brassica { **nigra,** (*Linné*) *Koch,* **juncea,** *Linné* (*Cosson*), and related varieties. } The dried ripe seed, with not more than 5 p. c. other seeds or other foreign organic matter, yielding not less than .6 p. c. volatile oil (allyl isothiocyanate).

Habitat. Asia, S. Europe, Africa, cultivated in gardens; wild in United States.
Syn. 1. Sinap. Nig., Brown Mustard, Cadlock, Kerlock; Sinapis Nigræ Semina; Fr. Moutarde noire (grise); Ger. Semen Sinapis, Schwarzer Senf, Senfsamen. 2. Sarepta, Indian or Russian Mustard.

Si-na'pis. L. fr. Gr. (*σί*)*ναπι*, Celtic *nap*, a turnip.

Bras'si-ca. L. for cabbage, fr. Celtic *bresic*, cabbage—*i. e.*, the fruit resemblance.

Jun'ce-a. L. *juncus*, a rush, reed—*i. e.*, from resemblance to rush (bulrush).

Ni'gra. L. *niger*, black—*i. e.*, the seed.

Mus'tard. L. *mustrum*, must—*i. e.*, seeds were once pounded with must or vinegar.

PLANTS.—*Brassica nigra*, erect annual, 1.3 M. (4°) high, smooth above, branched; leaves irregularly pinnatifid, faintly toothed; flowers 6 Mm. ($\frac{1}{4}'$) broad, yellow, racemes; fruit silique, 18 Mm. ($\frac{3}{4}'$) long, 1 Mm. ($\frac{1}{25}'$) broad, appressed, somewhat quadrangular, beak short, tapering, 3–7-seeded; *B. juncea*, glabrous or pubescent, glaucous, upper leaves oblong, subentire, attenuate at the base, lower lyrate, pedicels slender spreading, smaller than preceding; flowers 1.2–1.8 Cm. ($\frac{3}{5}$–$\frac{4}{5}'$) broad, not appressed; fruit (pod) 2–5 Cm. ($\frac{4}{5}$–$2'$) long. SEED, spheroidal, irregularly spheroidal, 1–1.6 Mm. ($\frac{1}{25}$–$\frac{1}{16}'$) broad; testa dark reddish-brown, sometimes yellowish-brown, with grayish tinge, minutely pitted or reticulate; embryo greenish-yellow, dark yellow, oily, 2 large cotyledons; odor slight (dry); when crushed and moistened, very irritating, strongly pungent, characteristic; taste strongly pungent, acrid. POWDER, light brown, greenish-brown—tissues of embryo, the cells containing small aleurone grains and fixed oil, the latter forming in large globules on adding chloral hydrate T. S.; fragments of seed-coat conspicuous, with yellow areas and small yellowish stone cells, few or no starch grains. In preparing powdered black mustard, some of its fixed oil may be removed to facilitate reduction. Should be kept, when powdered, in tightly-closed containers. *Solvents:* water; alcohol slightly. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—SEEDS: Those of allied species—radish, turnip, rape, the latter most common, but easily recognized by larger size and

peculiar bluish-red tint; Powder: Flour, starchy substances (blue with iodine), turmeric—rendering white mustard whiter (reddish-brown with borax or boric acid), red pepper (increasing pungency), sawdust (microscope); out of 27 samples examined only 8 were free of admixtures; white mustard recognized by not giving pungent fumes when mixed with water unless heated; Oil: Alcohol, carbon disulphide, castor oil, petroleum, artificial allyl isosulphocyanate, etc.

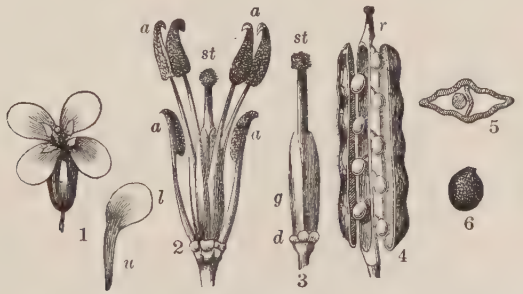


Fig. 152.—*Brassica nigra:* 1, flower; 2, pistil and stamens; 3, pistil; 4, silique; 5, cross-section of same; 6, seed; *a*, stamen; *st*, stigma; *g*, pistil carpels; *d*, nectar tubes; *r*, replum.

Commercial.—Plants are cultivated largely in England, United States, etc., and grow wild—the *white* (*Sinapis alba*), occasionally, the *black* commonly. The seed of each on grinding and sifting yield a yellow powder of characteristic odor and taste, and by mixing equal quantities of the two we obtain *mustard, flour of mustard* (Sinapis, Br.), which by trituration with water (vinegar) and spices yields the semi-solid *French mustard.*

Fig. 153.—Sinapis, magnified: *a*, transverse section; *b*, embryo; *c*, entire seed.

Constituents.—Fixed oil 30–35 p. c., Sinigrin (potassium myronate) .7–1.3 p. c., Sinapine sulphocyanide, lecithin, albumin 30 p. c., gum and mucilage 20 p. c. (mainly in testa), myrosin, other proteins, starch 1–2.5 p. c., ash 4–9 p. c.

Fixed Oil.—Usually termed "oil of mustard" is obtained by crushing seeds and expressing; it is yellowish-green, non-drying, sp. gr. 0.916, congeals at—18° C. (0° F.), slight odor, bland, mild taste; consists of glycerides of oleic, stearic, erucic (brassic) and behenic acids.

CRUCIFERÆ

Sinapine.—Alkaloid, here only as sulphocyanide, in colorless, bitter prisms, soluble in water, alcohol. Sinapine boiled with alkalies gives choline or sinkaline, $C_5H_{15}O_2N$, and sinapic acid, $C_{11}H_{12}O_5$.

Myrosin.—This ferment is an albuminoid body that becomes inert at 70° C. (158° F.), hence mustard heated to this point will not yield the volatile oil, owing to which the plasters should not be moistened with water warmer than the body temperature.

Sinigrin, $C_{10}H_{18}KNS_2O_{10}$.—Silky, white needles, or golden-yellow crystals, soluble in water, slightly in alcohol, insoluble in ether, chloroform; with water and the ferment myrosin it splits into glucose, acid potassium sulphate, and allyl sulphocyanide (isosulphocyanate—volatile oil of mustard) .5–1 p. c.

Oleum Sinapis Volatile. Volatile Oil of Mustard, *U.S.P.*—(Syn., Ol. Sinap. Vol., Mustard Oil, Oleum Sinapis Æthereum, Oil of Mustard; Fr. Essence de Moutarde; Ger. Oleum Sinapis, Senföl, Ätherisches Senföl.) This oil, like oil of bitter almond and to a great extent oil of gaultheria, does not preëxist in the plant, being obtained by macerating with warm water the crushed black mustard seeds (*B. nigra, B. juncea*), after the removal of fixed oil by expression, when a reaction (fermentation) sets in between sinigrin (potassium myronate) and myrosin (albuminoid ferment), provided the temperature does not exceed 70° C. (158° F.), at which the ferment becomes inert and ceases to act—$C_{10}H_{16}KNS_2O_9$ (sinigrin) + H_2O = C_3H_5CNS (volatile oil of mustard) + $C_6H_{12}O_6$ (glucose) + $HKSO_4$; also have formed allyl cyanide, carbon disulphide, allyl thiocyanate, and higher boiling compounds, which are always in the oil; when fermentation is completed the mixture is distilled with steam; this oil also is produced to a large extent synthetically by decomposing allyl iodide, C_3H_5I, with potassium sulphocyanate in alcoholic solution. It is a colorless, pale yellow, strongly refractive liquid, very pungent, irritating odor, acrid taste (in both exercise great caution, examining it only when highly diluted), optically inactive, sp. gr. 1.017, soluble in alcohol, carbon disulphide, volatile at 150° C. (302° F.); contains at least 93 p. c. of allyl isothiocyanate (isosulphocyanate), with traces of allyl cyanide, carbon disulphide, etc. *Tests:* 1. Distils completely between 148–154° C. (298–310° F.), first and last 10 p. c. portions have nearly the same sp. gr. as original oil (abs. of alcohol, chloroform, petroleum, fatty oils). 2. Dilute 1 cc. of oil with alcohol (5) + 1 drop of ferric chloride T. S.—no blue color (abs. of phenols). The label must indicate definitely its specific source, whether from black mustard or made synthetically. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏$\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 cc.).

PREPARATIONS.—SEEDS: 1. *Emplastrum Sinapis.* Mustard Plaster. (Syn., Emp. Sinap., Mustard Paper; Charta Sinapis, Fr. Papier moutarde (sinapisé), Moutarde en feuilles; Ger. Charta sinapisata, Senf papier.)

Manufacture: Percolate black mustard 100 Gm. with petroleum benzin until percolate gives no greasy stain on blotting paper, dry the powder; dissolve rubber 10 Gm. in petroleum benzin and carbon disulphide each 100 cc., and with this mix the purified mustard to produce a semi-liquid magma, spread on paper, cotton cloth, or other fabric; it is a uniform mixture of black mustard, deprived of its fixed oil, and a solution of rubber, spread on paper, cotton cloth, or other fabric; 100□Cm. contain 2.5 Gm. of black mustard deprived of its fixed oil. Before applying to the skin moisten thoroughly with tepid water, when it will produce a decided warmth and redness within 5 minutes. Should be kept in tightly-closed containers.

OIL: 1. *Linimentum Sinapis Compositum, N.F.*, 3 p. c. + fldext. mezereum 20 p. c., camphor 6, menthol 2, castor oil 15, alcohol q. s. 100. 2. *Spiritus Sinapis, N.F.*, 2 p. c., + alcohol q. s. 100. 3. *Unguentum Sinapis, N.F.*, 2 p. c., + white wax 15, lard 83.

Unoff. Preps.: SEED: *Infusion*, 5 p. c., dose, *ad libitum*. OIL: *Linimentum Sinapis (Br.)*, 3.5 p. c.

PROPERTIES.—Stimulant, emetic, tonic, diuretic, laxative, rubefacient, irritant, epispastic, carminative, condiment, vesicant; dilates the vessels, causing redness, warmth, and irritates sensory nerves, giving burning pain.

USES.—Atonic dyspepsia with constipation, delirium tremens, atonic dropsy, hiccough, narcotic poisoning. Externally—rheumatism, gout, atrophy, neuralgia, colic, gastralgia, inflammation of throat or lungs, toothache, earache, headache, vomiting, diarrhea, dysentery, amenorrhea, dysmenorrhea, stimulant to heart, respiration, and vascular system.

For mild action: Dilute mustard with equal quantity of flaxseed meal or flour, and make with water into a pasty plaster—poultice, cataplasm, or sinapism; should be applied enveloped in very thin muslin to prevent sticking, and is superseded almost entirely by the whole- and half-strength *mustard leaves*, which, in order to use, should be dipped into warm water for 15 seconds and applied for ½–1 hour. The volatile oil may be used locally, well diluted (ʒss; 2 cc.) + Stokes' liniment, alcohol, or almond oil ʒij; 60 cc. Good in scabies, hysteria, swooning convulsions.

Mustard foot-baths, valuable in headache, cerebral and other internal congestion, pneumonia, amenorrhea, for diaphoresis.

The infusion, made by stirring a tablespoonful to a cream with warm water, is a popular emetic in poisoning, etc., giving the entire mixture.

Allied Plants:

1. *Sinapis alba. White (Yellow) Mustard*, U.S.P. 1830–1910.—Plant and habitat similar to official. Seed, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, subglobular, testa yellowish, minutely pitted, embryo yellowish, oily, with curved hypocotyl, 2 conduplicate cotyledons; inodorous; taste mildly pungent, acrid; powder contains few or no starch grains; contains

fixed oil 20–25 p. c., sinalbin, sinapine sulphocyanide, lecithin, albumin 28 p. c., gum and mucilage 19 p. c. (mainly in testa), myrosin, other proteins, ash 4 p. c. Used for flavoring, etc., similar to the official, but milder in action as allyl isothiocyanate is not developed by macerating with water, but a weaker compound—acrinyl isosulphocyanide.

2. *Brassica arven'sis* (*Sinapis'trum*), *Charlock, Wild Mustard.*—Europe, United States; an annual, troublesome weed; seed smoothish, dark brown, smaller and less pungent, than our official black mustard. *B. olera'cea, Cabbage,* Europe; leaves large, smooth, glaucous, very different from cultivated varieties. *B. campes'tris;* Europe, Russia, Asia. Wild annual, .3–.6 M. (1–2°) high, flowers bright yellow; of this we have several cultivated varieties which give edible roots and seeds of some value, thus: (*a*) var. *Na'pus, Turnip*—seed larger than official black mustard, 1.6–2 Mm. ($\frac{1}{16}$–$\frac{1}{12}$′) thick, brown or black, finely pitted, slightly acrid; (*b*) var. *Ra'pa, Rape, Colza*—seed larger than mustard or turnip, 2–2.5 Mm. ($\frac{1}{12}$–$\frac{1}{10}$′) thick, finely pitted, blue-black, slightly acrid; both yield a bland, yellow fixed oil under the names of turnip-seed oil and rape-seed oil; (*c*) var. *Rutaba'ga, Swedish Turnip*—seed also small and contain oil and pungency.

Fig. 154.—*Brassica campestris.*

3. *Rori'pa* (*Cochlea'ria*) *Armora'cia, Armoraciæ Radix, Horseradish Root* (Br.—U.S.P. 1820–1850).—The fresh root collected from cultivated plants; E. Europe, naturalized elsewhere. Plant .6–1 M. (2–3°) high, in most places; leaves 20–30 Cm. (8–12′) long, 10–12.5 Cm. (4–5′) wide, toothed; flowers white; fruit 2-celled pod, each 4–6-seeded; root 30 Cm. (12′) long, 12–25 Mm. ($\frac{1}{2}$–1′) thick, conical, yellowish, scaly, warty, inside white, many stone cells, central pith, pungent odor when bruised; taste sharp, acrid; contains volatile oil .05 p. c. (isomeric with mustard oil, C_3H_5CNS), resin. Condiment, rubefacient, stimulant, diuretic; dyspepsia, rheumatism, dropsy, palsy, scurvy, hoarseness, vomiting; in infusion, spirit (Spiritus Armoraciæ Compositus (Br.), 12.5 p. c.), cataplasm. Dose, gr. 20–30 (1.3–2 Gm.); spirit, ʒj–2 (4–8 cc.).

4. *Raph'anus Raphanis'trum, Wild Radish, Jointed Charlock,* and *R. sati'vus, Garden Radish.*—Both contain a fixed oil resembling that from mustard, but the sulphuretted volatile oil of the latter differs in some respects.

5. *Dro'sera rotundifo'lia,* or *D. an'glica* and *D. longifo'lia, Drosera, Sundew, N. F.*—Droseraceæ. The air-dried flowering plant of the former, frequently mixed with the two latter closely allied species, or

at times wholly replaced by them with not more than 5 p. c. of foreign matter, yielding not more than 10 p. c. of acid-insoluble ash; N. Temperate zone, N. America. Small moss-like plant, glittering in sunshine when covered with dew. Matted or broken leaves, stems and fibrous black rootlets, reddish throughout; leaves mostly basal, petiolate; blade orbicular, 15 Mm. ($\frac{3}{5}$′) broad, reddish glandular tentacles above, scape filiform, smooth, 10–30 Cm. (4–12′) long, few 5-parted, small white fugacious flowers, raceme. *D. anglica*—leaves linear, obovate, glabrous or sparsely hairy petioles; *D. longifolia*—leaves spatulate, blades 2–3 times longer than broad, petioles and scape smooth; odorless; taste faintly bitter, acidulous. Powder, reddish-brown—oval-headed tentacles, few glandular hairs, stomata, fibro-vascular bundles, tracheæ, parenchyma containing reddish substance, few starch grains; solvent: 67 p. c. alcohol; contains resin (acrid, odorous, greenish-brown), glucose, citric, malic acid, ferments (converts

FIG. 155.—*Roripa Armoracia:* flower: *s*, calyx; *p*, corolla; *a*, stamen; *g*, fruit carpel; *n*, stigma.

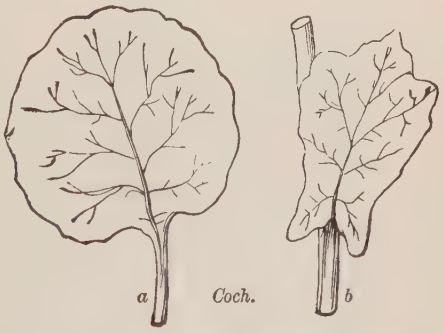


FIG. 156.—*Roripa Armoracia:* leaves; *a*, radical; *b*, cauline.

albumin into peptone), ash 30 p. c. Stimulant, expectorant; chronic bronchitis, whooping cough, tuberculosis—of doubtful efficacy. Dose, ℥ss–1 (2–4 Gm.); 1. *Fluidextractum Droseræ* (67 p. c. alcohol). Tincture 10 p. c.

28. HAMAMELIDACEÆ. Witch Hazel Family.

Ham-a-me-li-da′se-e. L. *Hamamel(is)-id* + aceæ, fr. Gr. ἅμα, together with, + μηλόν, fruit (apple)—*i. e.*, flowers and fruit together on the tree. Shrubs, trees. Distinguished by fragrant balsamic properties; ovary inferior, 2-celled, consisting of 2 pistils united below, forming 2-beaked, 2-celled, woody capsule; ovules 1 in each cell, pendent from cell apex, becoming bony seed; stamens 8, 4 perfect, 4 scale-like, sterile; flowers, heads or spikes, sometimes apetalous; calyx and petals 4–5; temperate climates, tropics; bitter, astringent, acrid, balsamic.

Genus: **1. Liquidambar.**

STYRAX. STORAX, *U.S.P.*

Liquidambar { **orientalis,** *Miller,* / **Styraciflua,** *Linné.* } A balsam obtained from the trunk.

Habitat. 1. Asia Minor—Southwestern portion near coast, forming entire forests; 2. United States—Atlantic coast southward.

Syn. Liquid Storax; 1. Levant Storax; 2. American Storax, Copalm Balsam; Oriental Sweet Gum, Storax Tree; Gum Tree, Sweet Gum, Alligator Tree, Lordwood; Br. Styrax Præparatus, Prepared Storax, Balsamum Styracis; Fr. Styrax liquide (purifie, depuratus); Ger. Styrax depuratus, Gereinigter Storax.

Liq-uid-am'bar. L. *liquidus,* liquid, fluid, + Ar. *ambar,* amber—*i. e.,* the color or fragrant, terebinthinate juice or resin (balsam) resembles liquid amber.

O-ri-en-ta'lis. L. oriental, pertaining to the Orient, or East—*i. e.,* its habitat.

Sty-ra-cif'lu-a. L. *styrax,* storax, + *fluo, fluere,* to flow—*i. e.,* storax sufficiently fluid at times to flow or exudate.

Sty'rax. L. for storax, Gr. *στύραξ,* altr. of Ar. *assthi'rak,* sweet-smelling exudation—*i. e.,* a tree producing it.

Plants.—Trees 6–15 M. (20–50°) high, resembling maples; bark purplish-gray; leaves palmately 5–7-lobed, each division obscurely 3-lobed, 5–7.5 Cm. (2–3′) long, 10–12.5 Cm. (4–5′) wide, margin serrate, bright green, smooth; flowers monœcious, in yellowish solitary heads; fruit, globular capsule, 2.5 Cm. (1′) broad, woody. Balsam (storax), a semi-liquid, grayish, grayish-brown, sticky, opaque mass, depositing on standing a heavy dark brown layer (Levant); or a semi-solid, sometimes a solid mass, softened by gently warming (American); thin layers transparent; odor and taste characteristic; heavier than water and insoluble in it; soluble (usually incompletely) in warm alcohol (1), also in acetone, carbon disulphide, ether (some insoluble residue usually remaining). *Tests:* 1. 2 Gm. dried 2 hours at 100° C. (212° F.) —loses 20 p. c. moisture. 2. Dissolve 10 Gm. in hot alcohol 40 cc.—undissolved residue 5 p. c.; evaporate filtrate—yellow to brown residue 70 p. c. (purified storax). *Solvents:* alcohol; ether. Dose, gr. 10–30 (.6–2 Gm.).

Adulterations.—Turpentine, sand, ashes, bark, mineral matter 13–18 p. c., water 10–40 p. c.

Commercial.—The balsam is not a physiological, but a pathological, secretion of the sapwood, existing only in injured trees as a result of wound stimulation—Nature's method of securing antisepsis and healing. To obtain 1, *Levant* storax in quantity—the outer bark on one side of the tree is bruised, resulting shortly thereafter in filling the cambium with rows of balsam glands and the inner bark with their exudation. The dead outer bark is taken off and rejected, while the inner is removed and boiled in sea-water—the balsam being skimmed from the surface with final expression of the boiled bark. It was once believed to be produced in the inner bark, which was collected and thrown into pits, to allow partial exudation, and ultimately subjected to pressure in strong horse-hair bags. Liquid storax is then put into barrels, goat skins, etc., and forwarded to Constantinople, Smyrna, Syria, Alexandria, Bombay, and Trieste. To obtain 2, *American* storax—incisions are made through the bark, or, in the absence of these,

during spring and summer, it exudates through natural fissures, from which it may readily be scraped. The greatest demand comes from India and China, the English-speaking people using little of it. The residual bark when dried (Cortex Thymiamatis) is employed for fumigation.

CONSTITUENTS.—A variable mixture chiefly of volatile oil, resins, cinnamic acid esters, and water—Styrol, Styracin, Phenylpropyl Cinnamate, Storesin, Cinnamic Acid, 5–15 p. c., benzoic acid, ethyl cinnamate, $C_9H_7(C_2H_5)O_2$, ethyl vanillin, water 10–40 p. c., other impurities, ash 1 p. c.

Styrol, Styrene, Styrolene (*cinnamene, phenyl-ethylene*), C_8H_8.—Hydrocarbon (volatile oil) obtained by distilling with water; it is a colorless fragrant oily liquid, sp. gr. 0.906, boils at 145° C. (293° F.), and when heated to 200° C. (392° F.) is converted into solid metacinnamene.

FIG. 157.—*Liquidambar orientalis.*

Styracin, Cinnamyl Cinnamate, $C_9H_7(C_9H_9)O_2$.—This is obtained in faint yellow crystals by alcohol, ether, or hot benzene from the resin after removal of cinnamic acid; with concentrated potassium hydroxide solution yields *styrone* (cinnamic alcohol), $C_9H_{10}O$, yellowish oily refractive aromatic liquid.

Phenylpropyl Cinnamate, $C_9H_7(C_9H_{17})O_2$.—This is a thick inodorous liquid.

Storesin, $C_{36}H_{58}O_3$.—This, the most abundant constituent, is amorphous, readily soluble in benzin, melts near 145° C. (293° F.), or near 165° C. (329° F.); the latter variety gives with potassium hydroxide a compound crystallizing in needles.

Cinnamic Acid, $C_9H_8O_2$.—Chiefly in free state, obtained by treating with solution of sodium carbonate, precipitating with hydrochloric acid.

PREPARATIONS.—1. *Tinctura Benzoini Composita*, 8 p. c.

Unoff. Prep.: Ointment (salve), 50 p. c., with lard or olive oil.

HAMAMELIDACEÆ

PROPERTIES.—Stimulant, expectorant, diuretic, antiseptic, disinfectant. Acts locally and remotely like benzoin, copaiba, balsams of Peru and tolu. Styracin is antiseptic, and should be dissolved in 6–12 parts of oil or water to render it non-irritating as a dressing.

USES.—Chronic bronchitis and catarrhs of genito-urinary passages, gonorrhea, gleet, amenorrhea, leucorrhea, phthisis, asthma. Externally in ointment as a detergent for indolent ulcers, frost-bites, as a parasiticide for scabies, phthiriasis (pediculi), etc.

Allied Product:

1. *Styrax Calamita.*—Resinous exudation from *Styrax officina'lis*, in agglutinated tears resembling benzoin, wrapped in leaves; a factitious variety consists of the ground, exhausted bark or sawdust mixed with liquid storax, formed into reddish-brown cylindrical cakes, brittle, friable, soft and unctuous to the touch; contains many crystals of styracin, and has storax odor.

Allied Plants:

1. *Hamame'lis virginia'na; Hamamelidis Folia, Hamamelis Leaves, Witch Hazel Leaves, N.F.*—The dried leaves with not more than 5 p. c. of stems nor 2 p. c. of other foreign organic matter; N. America, thickets, ponds, ditch banks. Woody shrub 1.5–4.5 M. (5–15°) high, 7.5–15 Cm. (3–6′) thick; stem crooked. Bark and twigs, in irregular quilled, bent pieces, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, grayish-brown, many lenticels, or reddish-brown, with short transverse ridges or scars, or somewhat scaly in old bark, thin corky layer easily removed from pale cinnamon-color middle bark, inner surface pale cinnamon, yellowish, smooth, finely striate, fracture short (young) or tough (old) in the bast layer. Leaves short, petiole 1–1.5 Cm. ($\frac{2}{5}$–$\frac{3}{5}$′) long, lamina broadly elliptical, inequilateral, 8–12 Cm. ($3\frac{1}{5}$–5′) long, acute, rounded, acuminate, slightly cordate and oblique, sinuate-dentate, pale or brownish-green with few stiff hairs above, lighter underneath, hairy, midrib and veins prominent; odor slight; taste astringent, aromatic, bitter. Powder, light-green—elliptical stomata, numerous stellate hairs and tracheæ, wood fibers, calcium oxalate prisms, crystal and bast-fibers; solvents: 33 p. c. alcohol, boiling water; contains tannin, volatile oil, bitter principle, extractive, ash 6 p. c. Astringent, hemostatic, styptic, sedative, tonic; external inflammations, congestion, sore throat (gargle), hemorrhages of nose, uterus, gums; piles, tumors, diarrhea. Dose, ℥ss–1 (2–4 Gm.); 1. *Fluidextractum Hamamelidis Foliorum* (leaves), 1st menstruum: glycerin 10, alcohol 30, water 50, 2d: 33 p. c. alcohol. 2. *Aqua Hamamelidis, Distilled Extract of Witch Hazel* (twigs), 100 p. c.; macerate 24 hours in water 200, distil 85, add alcohol 15; it is clear, colorless, characteristic odor and taste, neutral, faintly acid; must be free from mucoid or fungous growths, acetous odor, formaldehyde, acetone, methanol, dissolved impurities. Should be kept cool, in tightly-closed containers.

2. *Hydran'gea arbores'cens, Hydrangea, Seven-barks, N.F.*—Saxifragaceæ. The dried rhizome and roots with not more than 3 p. c. of foreign organic matter; N. America, on rocky banks near streams;

.3–2.5 M. (1–8°) high, stem grayish, bark exfoliates into thin layers (7), glabrous; leaves ovate, serrate, pale green beneath; flowers cymes, flat, greenish; fruit 2-celled, 2-beaked, many-seeded capsule. Rhizome, usually in pieces 3–10 Cm. ($1\frac{1}{5}$–4′) long, 3–20 Mm. ($\frac{1}{8}$–$\frac{4}{5}$′) thick, yellowish-brown, wrinkled, lenticels, stem-scars above, fibrous roots beneath; fracture tough, whitish, wood radiate—pith; roots 25 Cm. (10′) long, 2 Mm. ($\frac{1}{12}$′) thick—no pith; inodorous; taste sweetish, acrid. Powder, yellowish—tracheæ, tracheids, stone cells, numerous calcium oxalate raphides, starch grains; solvent: 60 p. c. alcohol; contains hydrangin (glucoside) 1 p. c., volatile oil, fat, resin, starch, ash 3 p. c. Diuretic, narcotic; renal and cystic calculi. Dose, gr.

Fig. 158.—*Hamamelis virginiana: A.* flowering twig; *B*, fruit-bearing twig; 1, flower, magnified; 2, sepal and stamen; 3, sepal, outer surface; 4, essential organs; 5, pistil; 6, fruit; 7, seed (four last longitudinal sections); 8, floral diagram.

15–30 (1–2 Gm.); 1. *Fluidextractum Hydrangeæ* (60 p. c. alcohol). 2. *Elixir Hydrangeæ et Lithii*, 40 p. c., + lithium benzoate and salicylate āā 2.6 p. c. Dose, ʒj–2 (4–8 cc.).

3. *Heu'chera america'na, Alum Root.*—The rhizome, U.S.P. 1820–1870; United States. Plant viscid, pubescent, .6–1.3 M. (2–4°) high; leaves 5–7.5 Cm. (2–3′) wide, crenate; flowers purplish-white; root 15 Cm. (6′) long, 12 Mm. ($\frac{1}{2}$′) thick, several-headed, many thin radicals, brownish-purple; bark thin, inodorous, astringent, bitter; contains tannin 18–20 p. c., starch 5–16 p. c. Astringent, tonic; diarrhea, menorrhagia, aphthæ, ulcers, hemorrhoids. Dose, gr. 15–30 (1–2 Gm.), in decoction.

RECAPITULATION TABLE NO. 2—U. S. P. DRUGS AND PREPARATIONS.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Dose.
Salicaceæ: 1. Salicinum. 2. Salicin.	Salix and Populus species.	A glucoside.	Europe, N. America.	$C_{13}H_{18}O_7$.	.....	Bitter, tonic, antiperiodic, antipyretic, antiseptic, antiferment.	Rheumatism, intermittents, coryza, neuralgia, diabetes, eczema, cancer, relieves pain.	Grains. 10–30 (.6–2 Gm.).
Fagaceæ (Cupuliferæ): 1. Galla. 2. Nutgall.	Quercus infectoria, + allied species.	The gall from young twigs.	Mediterranean Basin.	Tannin, gallic acid, mucilage, fat, resin, starch.	Oint., *Tannin:* glycerite, troch., oint., pyrogallic acid.	Astringent, tonic.	Diarrhea, gleet, relaxed membranes, sore mouth, antidote to alkaloidal poisoning.	5–30 (.3–2 Gm.).
Ulmaceæ: 1. Ulmus. 2. Elm.	Ulmus fulva.	The dried inner bark.	N. America.	Mucilage, starch, tannin, bitter principle.	.....	Demulcent, emollient, nutritive.	Diarrhea, urinary affections, bronchitis, boils, fissures, strictures.	120–240 (8–15 Gm.).
Moraceæ: 1. Cannabis. 2. Cannabis.	Cannabis sativa.	The dried pistillate flowering tops.	Asia, N. India, S. United States.	Cannabinol, Cannabin, choline, vol. oil.	Extract, fluidext.	Anodyne, nervine, sudorific, narcotic, aphrodisiac.	Neuralgia, gout, tetanus, chorea, hysteria, epilepsy, delirium tremens.	1–5 (.06–.3 Gm.).
Santalaceæ: 1. Oleum Santali. 2. Oil of Santal.	Santalum album.	The volatile oil.	S. India, E. Indian Islands.	Santalol—$C_{15}H_{26}O$, santalal, $C_{15}H_{24}O$.	.....	Astringent, stimulant, diuretic.	Bronchitis, gonorrhea, cystitis, pyelitis, diarrhea.	Minims. 5–20 (.3–1.3 cc.).
Aristolochiaceæ: 1. Serpentaria. 2. Serpentaria.	Aristolochia: Serpentaria, reticulata.	The dried rhizome and roots.	United States.	Volatile oil, aristolochine, resin, tannin, starch.	Tinct. cinch. co.	Stimulant, tonic, diaphoretic, antiperiodic.	Pneumonia, intermittents, dyspepsia, diphtheria.	Grains. 5–30 (.3–2 Gm.).
Polygonaceæ: 1. Rheum. 2. Rhubarb.	Rheum: officinale, palmatum, + varieties.	The dried rhizome and roots.	W. and C. China.	Resin, cathartic acid, vol. oil, chrysophanic acid, emodin, aloe-emodin, rheinolic acid, rhein, starch, rheotannic acid, Ca oxalate.	Extract., fluidext., syrup, pulv. comp., tinct., ar. tr., ar. syr.	Aperient, purgative, astringent, stomachic, tonic.	Diarrhea, hemorrhoids, chronic dysentery, thread-worms, bilious fever.	5–30 (.3–2 Gm.).
Chenopodiaceæ: 1. Oleum Chenopodii. 2. Oil of Chenopodium.	Chenopodium ambrosioides, var. anthelminticum.	The volatile oil.	W. Indies, C. and S. America.	Pinene, + $C_{10}H_{16}O$.	.....	Anthelmintic, vermifuge, roundworms.	Worms, intermittents, hysteria, chorea, nervousness, tenia.	Minims. 2–10 (.13–.6 cc.).
Myristicaceæ: 1. Myristica. 2. Myristica.	Myristica fragrans.	The dried ripe seed (kernel) without seed-coat.	Moluccas (Spice Islands), India.	Volatile oil, fixed oil, starch, proteins.	Tr. lav. co., tr. rhei ar., *Oil:* Sp. ammon. ar.	Stimulant, stomachic, condiment, flavoring, narcotic.	Flatulence, diarrhea, nausea, colic, dyspepsia, carminative.	Grains. 5–20 (.3–1.3 Gm.).
Ranunculaceæ: 1. Hydrastis. 2. Hydrastis.	Hydrastis canadensis.	The dried rhizome and roots.	N. America.	Hydrastine, berberine, canadine, resin.	Fluidextract.	Alterative, tonic, aperient, antiperiodic, nervine.	Dyspepsia, costiveness, malaria, jaundice, catarrh, gonorrhea.	5–30 (.3–2 Gm.).

1. Cimicifuga. 2. Cimicifuga.	Cimicifuga racemosa.	The dried rhizome and roots.	United States, Canada.	Cimicifugin, resins, vol. oil, fat, tannin.	Fluidextract.	Alterative, emmenagogue, sedative.	Bronchitis, rheumatism, amenorrhea, chorea, dyspepsia.	5–30 (.3–2 Gm.).
1. Aconitum. 2. Aconite.	Aconitum Napellus.	The dried tuberous root.	Europe, Asia, N. America.	Aconitine, aconine, picraconitine, pseudaconitine, resin, aconitic acid.	Tincture.	Sedative, anodyne, antipyretic, poison.	Sthenic fevers, pericarditis, rheumatism, neuralgia, pneumonia.	1–2 (.06–.13 Gm.).
Berberidaceæ:								
1. Podophyllum. 2. Podophyllum.	Podophyllum peltatum.	The dried rhizome and roots.	N. America.	Resin (podophyllin—podophyllotoxin), starch, fixed oil.	Resin.	Cathartic, tonic, alterative.	Constipation, torpid liver, diarrhea, fevers, jaundice.	5–15 (.3–1 Gm.).
Menispermaceæ:								
1. Calumba. 2. Calumba.	Jateorhiza palmata (calumba).	The dried root.	E. Africa.	Calumbin, berberine, calumbic acid, resin, starch.	Tincture.	Tonic, stomachic, stimulant.	Dyspepsia, debility, remittent fevers, diarrhea, phthisis.	5–30 (.3–2 Gm.).
Lauraceæ:								
1. Cinnamomum. 2. Cinnamon.	Cinnamomum Loureirii.	The dried bark.	Cochin China, Annam.	Volatile oil, tannin, sugar, mannite, starch.	Tr. card. co., tr. gambir. co., tr. lav. co., tr. rhei ar., *Oil:* aqua, spirit, inf. dig., mist. cret., syr. rhei., ar. sulph. ac.	Germicide, antispasmodic, carminative, stimulant, astringent, aromatic.	Parturient, flavoring, diarrhea, flatulence, nausea, menorrhagia.	5–30 (.3–2 Gm.).
1. Camphora. 2. Camphor.	Cinnamomum Camphora.	The dextrorotatory ketone.	China, Japan, Formosa.	$C_{10}H_{16}O$.	Aq., lin., spt., lin. chlorof., lin. sap., tr. opii camph.	Antispasmodic, stimulant, nervine, diaphoretic, resolvent, antiseptic.	Hysteria, nervousness, diarrhea, colic, rheumatism, tenesmus, asthma, cough, ulcers, scabies.	1–5 (.06–.3 Gm.).
1. Oleum Sassafras. 2. Oil of Sassafras.	Sassafras variifolium.	The volatile oil.	N. America.	Safrol, pinene, eugenol, *d*-camphor.	Syr. sars. co.	Alterative, diaphoretic, stimulant.	Skin diseases, rheumatism, syphilis.	Minims. 1–5 (.06–.3 cc.).
Papaveraceæ:								
1. Opium. 2. Opium.	Papaver somniferum, + var. album.	The air-dried milky exudation.	W. Asia.	Morphine, narcotine, codeine, narceine, meconic acid, ethyl morphine, apomorphine, cotarnine, etc.	Tr., tr. opii camph., pulv. ip. et opii, opium gran., opium pulv.	Narcotic, sedative, anodyne .	Diarrhea, peritonitis, cholera morbus, coughs, rheumatism, etc.	1–2 (.06–.13 Gm.).
Cruciferæ:								
1. Sinapis Nigra. 2. Black Mustard.	Brassica: nigra, juncea.	The dried ripe seeds.	Asia, S. Europe.	Fixed oil, sinigrin, sinapine sulphocyanide, myrosin.	Emplast., vol. oil.	Stimulant, emetic, tonic, diuretic, laxative, rubefacient, condiment.	Dyspepsia, delirium tremens, dropsy, poisoning, rheumatism, gout, colic, headache, etc.	15–60 (1–4 Gm.).
Hamamelidaceæ:								
1. Styrax. 2. Storax.	Liquidambar: orientalis, Styraciflua.	The balsam.	Asia Minor, United States.	Styrol, styracin, phenylpropyl cinnamate, cinnam. benzo. acids, storesin, vanillin.	Tinct. benzoini comp.	Stimulant, expectorant, diuretic, antiseptic.	Bronchitis, catarrhs, gleet, phthisis, asthma, amenorrhea.	10–30 (.6–2 Gm.).

29. ROSACEÆ. Rose Family.

Ro-za'se-e. L. *Ros'a* + aceæ, fem. pl. *rosace-us*, rose-like, fr. *rosa*, a rose. Trees, shrubs, herbs. Distinguished by astringency, succulent edible fruits, prickles and warts on woody surfaces; flowers regular, 5's; stamens inserted on calyx-tube, perigynous; calyx 4–5-lobed—when 5 the odd lobe posterior; anthers 2-celled; pistil 1-many, usually distinct; fruit often edible; seeds exalbuminous. The yellow and white flowers resemble Ranunculaceæ, where, however, the stamens and pistils are inserted on the torus, but in Rosaceæ on the calyx; temperate climates; astringent, tonic, anthelmintic; fruit edible.

Genus: **1. Rosa.**

ROSA. ROSE, *U.S.P.*

Rosa gallica, *Linné.* { The dried petals, collected just before the expansion of the flower.

Habitat. W. Asia, S. Europe; cultivated (England, Holland, France, United States, etc.).

Syn. Rosa Gallica, Red Rose, Rosa Gall., French Rose, Provins Rose; Br. Rosæ Gallicæ Petala, Red Rose Petals, Flores Rosarum Rubrarum; Fr. Rose rouge—de Provins, Roses rouges; Ger. Französische Rose, Essigrosen-(blatter), Zuckerrose.

Ro'sa. L. fr. Gr. *ῥόδον*, Eng. rose, fr. Celtic *rhos*, red—*i. e.*, the prevailing color of the flowers.

Gal'li-ca. L. *gallicus*, of or pertaining to Gaul, now France—*i. e.*, country where once it flourished extensively—French rose.

Plant.—Bushy shrub, .6–1 M. (2–3°) high, stems numerous, covered with prickles and a few sharp spines; leaves alternate, imparipinnate, 2 pairs opposite leaflets, these nearly sessile, ovate, rounded at base, acute at apex, serrate, stiff, keeled, rugose, with veins, pale, hairy below, leaf-serratures not edged with glands; flowers large, on long stalks, petals 5 in the wild state, more when cultivated, rich-crimson; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes, calyx persistent. Petals, either separate or imbricated in small cones, broadly ovate, summit rounded, deeply notched, margin entire, somewhat recurved, base obtuse, purplish-red except the light brown claw; texture velvety; when dry brittle; odor agreeable; taste astringent, slightly bitter. Powder, reddish-brown—epidermal cells with purplish-red content (sap), fragments of fibro-vascular bundles, spiral tracheæ, rectangular cells with purplish content (sap). *Solvents:* boiling water; diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Commercial.—Plant, in its many species and varieties, very largely cultivated domestically as well as commercially; petals are obtained by circumcising with a sharp knife the unopened corolla-buds, leaving the stamens behind on the calyx; or the entire blooms are cut off with knives or scissors, dried carefully but rapidly by stove heat (in order to preserve astringency and color), sifted, if necessary, from stamens,

etc., and marketed; early collection is more astringent and of better color, qualities impaired by slow drying. It is claimed that 1000 flower-buds yield 50 pounds (23 Kg.) of fresh petals, which when dried become 5 pounds (2.3 Kg.).

ADULTERATIONS.—Petals of various red roses.

CONSTITUENTS.—Volatile oil (trace), mucilage, tannin (rosatannic acid, quercitannic acid?), gallic acid, anthrocyanin—sap pigment, quercitrin, quercetin (astringent and coloring), sugar, ash 3.5 p. c.

PREPARATIONS.—1. *Fluidextractum Rosæ.* Fluidextract of Rose. (Syn., Fldext. Ros., Fluid Extract of Rose; Fr. Extrait fluide de Rose rouge; Ger. Essigrosenfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st. menstruum: alcohol 50 cc., water 40 cc., glycerin 10 cc.; 2d: diluted alcohol. Dose, ♏xv–60 (1–4 cc.).

Preps.: 1. *Mel Rosæ.* Honey of Rose. (Syn., Mellitum Rosatum; Fr. Mellite de Roses rouges, Miel Rosat; Ger. Mel rosatum, Rosenhonig.)

Manufacture: 12 p. c. Mix fluidextract of rose 12 cc. with honey q. s. 100 Gm. Dose, ʒj–2 (4–8 cc.).

Prep.: 1. *Massa Hydrargyri* (33 p. c.)—32 p. c.

2. *Syrupus Rosæ, N.F.*, 12.5 p. c., + diluted sulphuric acid 1 p. c.

2. *Aqua Rosæ Fortior.* Stronger Rose Water. (Syn., Aq. Ros. Fort., Triple Rose Water, Aqua Rosæ; Fr. Eau distillée fort de Rose; Ger. Stärkeres Rosenwasser.)

Manufacture: The saturated aqueous distillate from fresh flowers of *Rosa centifolia.* It is colorless, clear, strong, pleasant odor and taste of fresh rose blossoms, free from empyreuma, mustiness, or fungoid growths; neutral, slightly acid; evaporate 100 cc.—residue .001 Gm.; no reaction with hydrogen sulphide T. S., or sodium sulphide T. S. (abs. of metallic substances). Dose, ʒij–8 (8-30 cc.).

Preps.: 1. *Aqua Rosæ.* Rose Water. (Syn., Aq. Ros., Aqua Rosarum; Fr. Eau distillée de Rose; Ger. Rosenwasser.)

Manufacture: Mix, immediately before using, stronger rose water, and distilled water, each 1 volume. Dose, ʒij–8 (8–30 cc.).

2. *Unguentum Aquæ Rosæ.* Ointment of Rose Water. (Syn., Ung. Aq. Ros., Cold Cream; Fr. Crême froide; Ger. Unguentum leniens—emolliens.)

Manufacture: Melt, in fine pieces, spermaceti 12.5 Gm., white wax 12 Gm., add expressed oil of almond 56 Gm., stir, heat until uniform; add gradually stronger rose water 19 Gm., previously warmed and having dissolved in it sodium borate .5 Gm., stir rapidly and continuously until congealed and uniform; must be free from rancidity, and if chilled should be warmed slightly before incorporating other ingredients. Should be kept in pure tin, collapsible tubes.

3. *Confectio Rosæ, N.F.*, rose 8 Gm., sucrose 64, honey 12, stronger rose water 16, Dose, ʒss–1 (2–4 Gm.).

ROSACEÆ

3. *Infusum Rosæ Compositum, N.F.*, 1.3 p. c., + diluted sulphuric acid .9, sucrose 4, boiling water q. s. 100. Dose, ʒ ss–2 (15–60 cc.). 4. *Pilulæ Aloes et Mastiches, Lady Webster Dinner Pills, N.F.*, ½ gr. (.03 Gm.).

Unoff. Preps.: Infusion, 3.5 p. c. *Infusum Rosæ Acidum* (Br.) 2.5 p. c., + diluted sulphuric acid 1.25, water q. s. 100.

PROPERTIES.—Similar to tannin; tonic, mild astringent, carminative.

USES.—Uterine and other hemorrhages, aphthæ, ulcers of mouth, ears, anus, inflamed eyes, chapped hands, burns, flavoring vehicle, perfumery; ointment—soothing, emollient application to the skin, chapped hands and lips, abrasions, ulcers, frost-bite, etc.

Allied Plants:

1. *Rosa centifo'lia, Pale Rose.*—The petals, collected after expanding, U.S.P. 1820–1890; W. Asia. Plant erect, 1–2 M. (3–6°) high, similar to but larger than *Rosa gallica;* stems covered with prickles, larger ones hooked; leaves imparipinnate, 2 pairs of opposite leaflets; flowers large, double, calyx persistent; fruit (hip) scarlet to orange-red, oblong, containing many 1-seeded achenes. Petals numerous, roundish-obovate, retuse, or obcordate, pink, fragrant, sweetish, slightly bitter, faintly astringent; contain volatile oil, mucilage, sugar, tannin, malates, phosphates (quercitrin?). This, although often mistaken for the Damask rose, is no doubt the most anciently cultivated variety of *R. gallica,* and exists in many hybrid forms which are employed indiscriminately. Used as mild carminative, for distilling the oil and U.S.P. stronger rose water—the latter being of fine flavor, and more used in this country, owing to prevalence and cheapness, than the imported. Dose, gr. 15–60 (1–4 Gm.). *R. cani'na, Dog Rose,* United States; leaflets 5–7, ovate, serrate, flowers pink, white; *R. blan'da, R. nit'i-da,* also employed.

FIG. 159.—*Rosa canina.*

2. *R. damasce'na, Damascus Rose.*—The volatile oil distilled from fresh flowers, U.S.P. 1840–1900; India, N. Africa, S. France, Bulgaria (Roumelia). Plant, prickly, resembling the ordinary rose bush, cultivated in hedge-like rows on southern slope of Balkan Mountains. Oil (otto, attar, essence of rose) pale yellow, transparent liquid, fragrant rose odor, mild sweetish taste, sp. gr. 0.860, alcohol (70 p. c.) precipitates stearoptene but dissolves eleoptene, congeals at 18–22° C. (64–72° F.); consists of solid portion (stearoptene) 12–14 p. c., being a mixture of odorless hydrocarbons, $C_{20}H_{42}$, etc., and a liquid portion (eleoptene) composed of (1) geraniol (rhodinol), $C_{10}H_{18}O$, 75 p. c., most fragrant, oxidized into aldehyde, citral (rhodinal), readily soluble in alcohol, (2) citronellol, $C_{10}H_{20}O$, small amount; when congealed should

be liquefied by warming before dispensing. *Adulterations:* Spermaceti, paraffin (crystallize in opaque crust), fixed oils, volatile oils of guaiac-wood, palmarosa, rose geranium, etc.—having one or more similar ingredients (geraniol, etc.), recognized by congealing point and saponification value (10–17); synthetic rose oils—now largely manufactured as a substitute. Stimulant, carminative, aromatic; chiefly in perfumery, flavoring.

3. *Ru'bus villo'sus, R. nigrobac'cus, R. cuneifo'lius,* + *Eubatus* section, *Rubus, Blackberry Bark, N.F.*—The dried bark of the rhizome and roots with not more than 10 p. c. of adhering wood nor 3 p. c. of other foreign organic matter; N. America, fields, thickets, cult. Pubescent perennials; stems angular, woody, with stout recurved prickles; leaflets 3–5, ovate, cuneate, petiolate, serrate, rough above, pubescent beneath, 2.5–10 Cm. (1–4′) long; flowers white, racemes; fruit (aggregate drupe —carpels 20 +), 12–25 Mm. ($\frac{1}{2}$–1′) long, black, pulpy, delicious. Bark of rhizome 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, in long, tough, flexible bands or quills, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, brownish, grayish-brown, smooth or

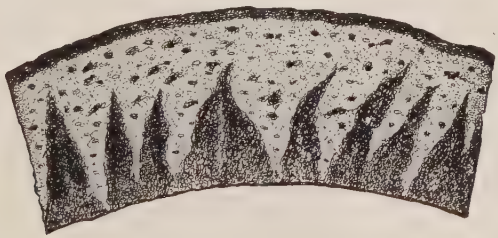


Fig. 160.—*Rubus villosus:* transverse section of bark, magnified 15 diam.

scaly, inner surface yellowish, coarsely striate, fracture tough-fibrous, readily splitting; inodorous; taste strongly astringent, bitterish. Powder, dark brown—cortical parenchyma, calcium oxalate rosettes, many simple and compound starch grains, cork tissue; solvents: boiling water, diluted alcohol; contains tannin 12–17.5 p. c., gallic acid .4 p. c., villosin (saponin) .8 p. c., resin 7 p. c., volatile oil, fixed oil, wax, ash 3 p. c. Astringent, tonic, similar to tannin; diarrhea—children and adults in summer. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Rubi* (diluted alcohol), dose, ♏x–60 (.6–4 cc.): Prep.: 1. *Syrupus Rubi,* 25 p. c., dose, ʒj–4 (4–15 cc.). Decoction, 5 p. c. (water or milk), ʒj–2 (30–60 cc.); Syrup of fruit (juice 100, sucrose 200—heat); Wine; Brandy.

4. *R. Idæ'us,* or *R. strigo'sus; Rubi Idæi Fructus, Raspberry, N.F.*—The fresh, ripe fruit of several varieties; Europe, N. Asia, N. America. Shrub 2 M. (6°) high, glaucous, spinose; leaves imparipinnate, 1–3 pairs, sessile, ovate, serrate, whitish, downy leaflets; flowers white, 5's. Fruit, deprived of conical receptacle (hollow base), globular, hemispherical, composed of 20–30 small, rounded, polygonal, succulent drupelets (aggregate fruit), pericarps red, numerous non-globular hairs,

ROSACEÆ

mesocarps fleshy, juice red, parenchyma with calcium oxalate rosettes, endocarps small stones, wrinkled; odor characteristic, aromatic; taste pleasant, sweet, acidulous. Black Raspberries, the fresh ripe fruit of varieties of *R. occidenta'lis*, may be substituted for pharmaceutical purposes, either in part or wholly for Red Raspberries; most of these plants grow wild and under cultivation throughout N. America, supplying fruit that is in great demand, and a juice that ferments into wine, which upon distillation yields brandy more or less popular in bowel affections; contains volatile oil (trace), citric acid, malic acid, sugar 5 p. c., pectin, coloring matter. Refrigerant, mild laxative, dietetic; used as edible fruit and for preparing syrup; 1. *Syrupus Rubi Idæi;* add to every 100 cc. of clear, boiled, filtered juice, 200 Gm. sucrose: Preps.: 1. *Elixir Bromidorum Quinque,* 15 p. c. 2. *Elixir Gentianæ Glycerinatum,* 6 p. c.

Fig. 161.—*Rubus Idæus.*

5. *Quilla'ja Sapona'ria, Quillaja, Soap (Tree) Bark, N.F.*—The dried inner bark with not more than 5 p. c. of outer bark nor 1 p. c. of foreign organic matter; Chile, cult. in N. Hindustan. Tree 15–18 M. (50–60°) high; leaves oval, evergreen, coriaceous; flowers white, monœcious; fruit capsule with persistent calyx, many seeded. Bark in flat pieces of variable length, 3–8 Mm. ($\frac{1}{8}$–$\frac{1}{3}'$) thick, or small chips, brownish-white, often with cork patches, nearly smooth, occasional depressions, conical projections or channels; inner surface yellowish-white; fracture uneven, strongly fibrous; odor slight, taste acrid. Powder, pinkish-white, very sternutatory—elongated calcium oxalate prisms, irregular crystal-fibers with thick lignified walls, medullary rays, stone cells, starch grains, cork cells with brownish walls; solvents: alcohol, hot water; contains saponin (quillajic acid, $C_{19}H_{30}O_{10}$ + quillaja-sapotoxin, $C_{17}H_{25}O_{10}$), $C_{32}H_{56}O_{18}$, 9 p. c., starch, gum, sucrose, calcium oxalate and sulphate. Stimulant, diuretic, expectorant, irritant, sternutatory, detergent, local anesthetic, antipyretic, paralyzant to heart and respiration, irritant to respiratory passages, poison to voluntary muscles; like senega; bronchitis, coryza, rhinitis, emulsifying agent, eruptions, scalp sores, fetor of feet, hair tonics, washing silks. Dose, gr. 15–30 (1–2 Gm.); 1. *Tinctura Quillajæ*, 20 p. c. (boiling water, then 35 p. c. alcohol); dose, ʒss–1 (2–4 cc.); 2. *Liquor Picis Carbonis,* 10 p. c. Fluidextract, ♏v–15 (.3–1 cc.).

6. *Hage'nia abyssin'ica, Brayera, Kousso, Cusso, N.F.*—The dried panicle of the pistillate flowers with not more than 10 p. c. of staminate flowers or other foreign organic matter, yielding not more than 5 p. c. of acid-insoluble ash; stems over 3 Mm. ($\frac{1}{8}'$) thick and all binding material must be rejected before powdering or using; Abyssinia, tablelands,

FIG. 162.—*Quillaja Saponaria.*

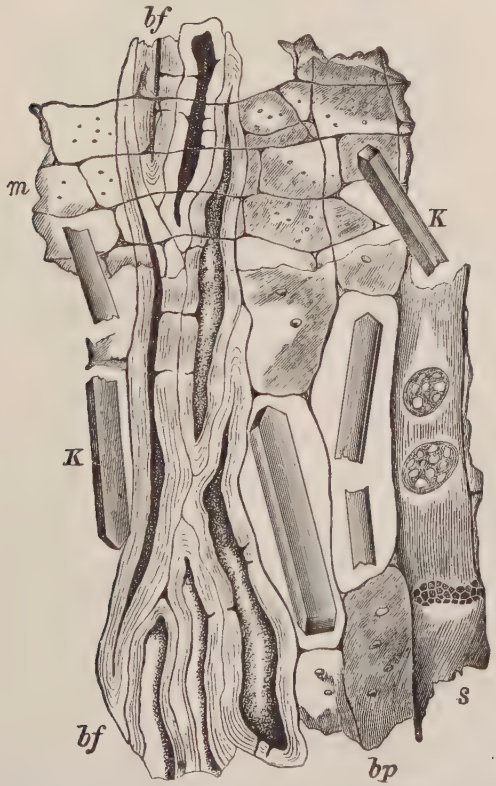


FIG. 163.—*Quillaja Saponaria*, longitudinal section: *bf*, bast-fiber; *bp*, sieve-parenchyma; *s*, sieve-tube; *m*, medullary ray; *K*, crystal.

mountains. Ornamental tree, 6–12 M. (20–40°) high; leaves 25–30 Cm. (10–12′) long, imparipinnate, leaflets 3–6 pairs, 7.5–10 Cm. (3–4′) long, sessile, serrate; flowers monœcious—staminate (Kousso-esels) greenish-yellow, with 20 fertile stamens. Pistillate (Red kousso) in reddish-brown rolls, flattened bundles, 25–50 Cm. (10–20′) long, or more or less lose and stripped from larger portions of the panicles, branches cylindrical, flattened, furrowed, light brown, yellowish, tomentose, glandular; cork brownish, fibro-vascular bundles in wedges, pith large, nodes with scar or branch, internodes 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) long;

FIG. 164.—*Hagenia Abyssinica: A*, branch of panicle; *B*, staminate flower; and *C*, pistillate flower, magnified 4 diam.

flowers with bracts, calyx turbinate, purple-veined bractlets; petals 5, caducous, usually absent in drug, carpels 2, stigmas broad, hairy, fruit achene, 2 Mm. ($\frac{1}{12}$′) thick; odor slight, taste bitter. Powder, brownish—non-glandular hairs, glandular hairs, tracheæ, pith, stomata, calcium oxalate rosettes, prisms, pollen grains; solvents: alcohol, boiling water; contains kosin (amorphous resins) 6.25 p. c., volatile oil, tannin 24 p. c., kosidin, protokosin, kosotoxin, ash 5–9 p. c. Anthelmintic, tænifuge. Dose, ʒij–6 (8–24 Gm.); 1. *Infusum Brayeræ*, 6 p. c., dose, ℥ij–8 (60–240 cc.). Fluidextract (alcohol); kosin (koussin, brayerin—amorphous impure best), gr. 5–30 (.3–2 Gm.).

7. *Ge'um riva'le, Purple (Water) Avens.*—The rhizome, U.S.P. 1820–1870; N. America. Perennial plant .3–.6 M. (1-2°) high, stem purple; leaves 3-foliate or 3-lobed; flowers purplish-orange. Rhizome 5–7.5 Cm. (2–3′) long, 6 Mm. (¼′) thick, tuberculate, wrinkled, brownish-red; bark thin, wood-wedges white, pith large; aromatic, astringent, bitter; contains volatile oil, tannin, bitter principle. Astringent, tonic; diarrhea, hemorrhage, leucorrhea, phthisis, scrofula, rheumatism, intermittents, dyspepsia, menstrual derangements; decoction, infusion, tincture. Dose, gr. 15–30 (1–2 Gm.).

8. *Potentil'la Tormentil'la, Tormentil.*—The rhizome, U.S.P. 1820–1870; Europe. Plant resembles *P. canaden'sis, Cinquefoil,* perennial, 25–30 Cm. (10–12′) high, green or reddish leaves, trifoliate; leaflets cuneate; flowers yellow; fruit achenes, reniform. Rhizome 5 Cm. (2′) long, 12 Mm. (½′) thick, tuberculate, brownish-red; bark thin, wood-wedges small, distant; pith large, inodorous, astringent; contains tannin 25 p. c., red coloring matter (tormentil-red), kinovic acid, ellagic acid. Astringent, tonic like kino and catechu; diarrhea, dysentery, spongy gums (gargle), ulcers, gleet; decoction, infusion. Dose, gr. 10–30 (.6–2 Gm.).

Fig. 165.—*Potentilla Tormentilla:* rhizome and transverse section.

Fig. 166.—*Porteranthus stipulatus.*

Fig. 167.—*Porteranthus trifoliatus:* rootlets, natural size.

DRUPACEÆ

9. *Spirœ'a tomento'sa, Hardhack.*—The root, U.S.P. 1820–1870; N. America; shrub, .6–1 M. (2–3°) high, stem ferruginous, tomentous, leaves dark green, but rusty-white beneath; flowers purple; fruit 1-seeded pod; root consists of brown, bitter, astringent bark, and hard, white, tasteless wood; contains tannin, bitter principle, volatile oil. Astringent, tonic; diarrhea, cholera infantum, hemorrhages, gonorrhea, ulcers, etc.; infusion, decoction, extract. Dose, ʒss–1 (2–4 Gm.).

10. *Porteran'thus stipula'tus* (*Gille'nia stipula'cea*), *Indian Physic,* and *P. trifolia'tus* (*G. trifolia'ta*), *American Ipecac.*—The root, U.S.P. 1820–1870; United States; shrubs .6–1 M. (2–3°) high, stems reddish-brown, leaves trifoliate; leaflets 5–10 Cm. (2–4′) long, pubescent; flowers white, pink; root (rhizome) 12–25 Mm. (½–1′), thick, with thin bark and many fissured rootlets, 3–6 Mm. (⅛–¼′) thick, bitter; contains gillenin, resin, tannin. Emetic (substitute for ipecac), purgative, tonic; infusion, decoction, tincture; very popular with North American Indians. Dose, emetic, gr. 15–30 (1–2 Gm.); tonic, gr. 2–5 (.13–.3 Gm.).

30. DRUPACEÆ. Plum Family.

Dru-pa′se-e. L. *Drup-a* + aceæ, fr. Gr. δρῦς, tree, + πέπτ-ειν, ripen, δρυπεπής, ripened on the tree—*i. e.*, the stone fruit. Trees, shrubs. Distinguished by bark and seeds containing hydrocyanic acid (poisonous), the former exuding gum, bitter; calyx 5-lobed, campanulate; petals 5, on calyx, stamens many; pistil 1, ovary 1-celled, 2-ovuled; fruit drupe; temperate climates; tonic, astringent, sedative, nutritious, lumber.

Genera: **1. Prunus. 2. Amygdalus.**

PRUNUS VIRGINIANA. WILD CHERRY, *U.S.P.*

Prunus serotina, *Ehrhart.* { The stem-bark collected in autumn and carefully dried. Borke (ross—sloughing dead tissues), if present, should be removed.

Habitat. N. America (Can. to Fla., to Minn., Neb., Kan., La., to Texas), in woods.

Syn. Prun. Virg., Wild Black Cherry Bark, Cabinet (Rum, Whisky, Black-choke, Wild) Cherry; Br. Pruni Virginianæ Cortex, Virginian Prune Bark; Fr. Écorce de Cérisier de Virginie; Ger. Wildkirschenrinde.

Pru′nus. L. fr. πρῦνη, a plum tree; *prunum,* a plum—*i. e.*, classic name.

Se-rot′i-na. L. *serotinus,* fr. *serus,* late—*i. e.*, the latest of the genus to bloom and fruit.

Vir-gin-i-a′na. L. of, or belonging to Virginia—*i. e.*, Virginian.

Plant.—Large tree 9–24 M. (30–80°) high; trunk regular, straight, with blackish, rugged outside bark, that of young branches smooth, red or purplish; leaves 5–12.5 Cm. (2–5′) long, oval, petiolate, serrate, teeth glandular, glabrous, shining, bright green, with 2 small glands on the margin at the base; flowers May–June, appearing after the leaves,

small, white, racemes; fruit August, drupe, size of a pea, purplish-black, pulpy, sweet, acidulous, slightly astringent and bitter—bitter cherries; seed subglobular bitter almond flavor, containing bland, yellowish-green fixed oil 25 p. c. BARK, usually in transversely curved pieces, 2.5–8 Cm. (1–3⅕′) long, 12–25 Mm. (½–1′) broad, .5–8 Mm. (⅕₀–⅓′) thick; outer surface (rossed bark) light brown, greenish-brown, smooth, except numerous lenticel-scars (unrossed bark), reddish-brown, glossy, smooth, with light colored, transversely elongated lenticels, roughened, flaky with gray lichens; inner surface light brown, with delicate, reticulate striations, numerous minute fissures; fracture short, granular; odor distinct, resembling bitter almond when macerated in water; taste astringent, aromatic, agreeable bitter. POWDER, light brown—fragments of yellow-brown cork, stone cells, few bast-fibers, not greatly elongated, frequently accompanied by crystal-bearing fibers, calcium oxalate prisms, rosette aggregates, starch grains .002–.015 Mm. (1/125 00–1/1665′) broad. Young, thin bark best, and that from very large or small branches should be rejected. Should be kept dark, in tightly-closed containers. *Solvents:* hot or cold water. Dose, ʒss–1 (2–4 Gm.).

FIG. 168.—*Prunus serotina.*

ADULTERATIONS.—Unrossed bark, that of old stems, also that of choke cherry, which closely resembles the official, but as a rule is either thinner or thicker, and breaks with a very tough fracture like slippery elm.

Commercial.—The Latin official name, from its long usage, has been retained, although misleading; *Prunus virginiana* was given early by Linnæus to Choke Cherry, a shrub 2.5–3 M. (8–10°) high, having more sharply-toothed leaves, shorter racemes, and astringent, dark red, crimson fruit, size of wild cherry. It has received various names at different times, as *Prunus ru'bra, P. obova'ta, P. virginiana, P. serotina, Cerasus serotina, C. virginiana.* The true official *Prunus serotina* grows in fertile soil in fields, woods, along fences, seldom in clusters; wood is valuable for furniture, being hard, red, fine-grained, and easily polished. Bark after collection is (rossed) deprived of outside layer (periderm or ross—cork and parenchymatous cells), exposing green phelloderm, and then dried; while that from all portions of the tree is used, that from the root is strongest, yet it all soon deteriorates, consequently only the fresh-dried should be employed; the average bark collected in April yields most starch, but least tannin, and hydrocyanic acid—.0478 p. c.; in June—.0956 p. c.; in Oct.—.1436 p. c. or ⅐ gr. (.009 Gm.) from 100 gr. (6.5 Gm.) bark, which equals 7–8 ♏ (.5 cc.) of 2 p. c. acid; some bark reverse these seasonal percentages; young bark may yield of acid .183–.250 p. c., old bark .159–.335 p. c.

DRUPACEÆ

CONSTITUENTS.—Amygdalin, Emulsin, Bitter principle, tannin 2–4.5 p. c., gallic acid, resin, starch, (volatile oil, hydrocyanic acid, benzoic acid from oxidation of benzaldehyde?).

Amygdalin.—Cyanogenetic glucoside, similar to laurocerasin (prulaurasin) obtained by the action of alcohol; it is bitter, non-crystalline, and not precipitated by ether, hence in this differs from that in bitter almond.

Emulsin.—Enzyme or ferment, identical with emulsin or synaptase, extracted by water; white powder when pure, and by its action on amygdalin, in the presence of water, develops hydrocyanic acid and the volatile oil of bitter almond, neither of which, as such, existed previously in the bark. These two are obtained also by distilling the seed with water, when they come over more or less mixed. The poisonous property of the oil depends largely upon the amount of acid present, and when freed of this, the oil becomes a bland, colorless liquid resembling that from bitter almond. Some think the ferment neither emulsin nor synaptase, but a closely analogous compound.

Bitter Principle.—Obtained by mixing soft aqueous extract with alcohol, shaking with milk of lime, evaporating filtrate, boiling residue with alcohol, evaporating, getting brown, bitter, gelatinous mass, which is insoluble in ether, soluble in alcohol, brownish-red with sulphuric acid.

PREPARATIONS.—1. *Syrupus Pruni Virginianæ.* Syrup of Wild Cherry. (Syn., Syr. Prun. Virg.; Br. Syrup of Virginian Prune; Fr. Sirop d'Écorce de Cerisier; Ger. Wildkirschenrindensirup.)

Manufacture: 15 p. c. Mix glycerin 5 cc. with water 20, moisten wild cherry bark 15 Gm. with 10 cc. of mixture, pack in percolator, add remainder of mixture, and enough water to saturate and leave stratum above, macerate for 24 hours, percolate with water into sucrose 80 Gm. q. s. 100 cc., dissolve by aggitation without heat. Should be kept cool, in non-metallic, tightly-closed containers, as it rapidly loses hydrocyanic acid under favorable conditions. Dose, ʒj–4 (4–15 cc.); mainly for flavoring.

2. *Fluidextractum Pruni Virginianæ, N.F.*, moisten, 100 Gm., with glycerin 20 cc. + water 40, pack, macerate 24 hours; percolate with alcohol 25 cc. + water 15, finally with 25 p. c. alcohol q. s., 100 cc. Dose, ʒss–1 (2–4 cc.): Prep.: 1. *Elixir Taraxaci Compositum, N.F.*, 3.5 p. c.

3. *Syrupus Pini Albæ Compositus, N.F.*, 8.5 p. c.

Unoff. Preps.: Infusion, 4 p. c., dose, ʒss–2 (15–60 cc.). *Tinctura Pruni Virginianæ* (Br.), 20 p. c. + alcohol 62.5 p. c., finally add glycerin 10 p. c., dose, ʒss–1 (2–4 cc.).

PROPERTIES.—Sedative, pectoral, aromatic bitter tonic, astringent; increases appetite, digestion. Volatile oil—local stimulant on alimentary canal like cascarilla, serpentaria, etc. Hydrocyanic acid—sedative, nervine, large doses decrease heart action. Tannin is astringent.

Uses.—Consumption, cough, bronchitis, scrofula, heart palpitation, stomach atony, dyspepsia, hectic fever, debility; cold infusion in ophthalmia. It is much inferior to cinchona in intermittents.

Allied Plants:

1. *Prunus domes'tica, Prunum, Prune, N.F.*—The partly dried ripe fruit, with 30–35 p. c. of natural moisture when used for pharmaceutical purposes; W. Asia, cult. in S. France, California. Tree, 4.5–6 M. (15–20°) high; leaves 5 Cm. (2′) long, dentate, ovate, pubescent beneath; flowers whitish. Fruit (drupe), 3–4 Cm. ($1\frac{1}{5}$–$1\frac{3}{5}$′) long, ellipsoidal, brownish-black, shriveled, sarcocarp sweet, acidulous, putamen hard, smooth or ridged; seed almond-shaped, but smaller, bitter almond taste. Of the several varieties, the St. Catherine and Greengage are finer as a dessert, and Prune de St. Julian (France) as a medicine; contains sugar 12–25 p. c., pectin, albumin, malic acid, tartaric acid, salts; seed—fixed oil, amygdalin, emulsin. Nutritive, laxative, demulcent; constipation—skins indigestible; fermented and distilled for brandy, which contains alcohol 40 p. c. Should be kept cool, in air-tight containers. Dose, *ad libitum;* 1. *Confectio Sennæ*, 7 p. c.

Fig. 169.—*Prunus Laurocerasus.*

2. *P. Laurocer'asus, Cherry Laurel, Laurocerasi Folia* (Br.).—Fresh leaves; W. Asia. Ornamental shrub or tree, 3–6 M. (9–20°) high; leaves 15 Cm. (6′) long, obovate, oblong, serrate, coriaceous; bitter almond odor; aromatic, bitter taste; contains prulaurasin, $C_{40}H_{67}O_{30}N$ (similar to amygdalin), emulsin, tannin, sugar, fat, wax, phyllic acid (crystalline, occurring also in leaves of almond, apple, maple, peach); yields hydrocyanic acid .12 p. c., and oil of bitter almond (benzaldehyde) .5 p. c., in which spring leaves are richest. Sedative, narcotic; used to make cherry laurel water (*Aqua Laurocerasi*, Br.) by distilling 400 cc. from leaves 320 Gm. + water 1000 cc. Dose, ʒss–2 (2–8 cc.).

AMYGDALA AMARA. BITTER ALMOND.

Oleum Amygdalæ Amaræ. Oil of Bitter Almond, *U.S.P.*

Amygdalus communis (var. **amara**), *Linné*, or other kernels containing amygdalin.	A volatile oil from the dried ripe kernels (deprived of fixed oil) obtained by maceration with water and subsequent distillation with steam.

DRUPACEÆ

Habitat. W. Asia, Persia, Syria, Barbary, Morocco; naturalized in Mediterranean Basin; cultivated in Europe; unsuccessfully in United States.

Syn. Greek Nuts; Ol. Amygd. Amar., Bitter Almond Oil, Oleum Amygdalarum (Amararum) Æthereum; Fr. Amande amère; Essence d'Amande amère; Ger. Amygdalæ Amaræ, Bittere Mandeln; Bittermandelöl.

A-myg'da-lus. L. fr. Gr. *αμύσσω*, to lacerate—*i. e.*, its fissured shell.

Com-mu'nis. L. common, general—*i. e.*, the ordinary or common species.

A-ma'ra. L. *amarus*, bitter—*i. e.*, the fruit.

PLANT.—Small tree, 5–6 M. (15–20°) high, bark purplish; leaves bright green; flowers pale pink or white; fruit drupe, ovate, 5 Cm. (2′) long, 2.5 Cm. (1′) broad, sarcocarp green, leathery, splitting into two halves when ripe, and falling from the stone. This remaining stone is the commercial almond, and may be sold as such or may be bleached by sulphur dioxide, thereby also killing any attached insects. By cracking off hard shell the kernel, or, properly, the seed, is left, which, when deprived of papery endocarp by hot water, constitutes the more desirable blanched almond. Seed (almond), 2.5 Cm. (1′) long, oblong-lanceolate, flattish; testa cinnamon-brown, thin, finely downy, marked by about 16 lines radiating from broad scar at blunt end; embryo straight, white, oily, with 2 plano-convex cotyledons; taste bitter, oleaginous; triturated with water yields milk-white emulsion, emitting odor of hydrocyanic acid.

ADULTERATIONS.—SEED: Sweet almonds chiefly (Valencia) and peach seed—both cheaper; the bitter differs from the sweet in flavor, odor with water, containing amygdalin, being shorter, broader, thinner, less plump and darker, and from peach seed by being much larger; OIL: Alcohol, oil of turpentine, nitrobenzene, impure benzaldehyde from toluene (chlorine), etc.

Commercial.—There are several varieties of these (*French*, *Sicily*, *Barbary*, in the order of value), being exported chiefly from Mogador, in Morocco.

CONSTITUENTS.—KERNELS: Fixed oil 46 p. c., Amygdalin 1–3 p. c., Emulsin, mucilage 3 p. c., proteins (myosin, vitellin, conglutin) 24–30 p. c., precipitated by acetic acid, sugar 6 p. c., ash 3.5 p. c.—K, Ca, Mg—phosphates); yield volatile oil 1 p. c.; hydrocyanic acid .25 p. c.

Amygdalin, $C_{20}H_{27}O_{11}N$.—A crystalline cyanogenetic glucoside obtained from expressed cake (deprived of fixed oil) by boiling in alcohol, distilling to syrup, adding water and yeast, and then allowing fermentation; after this, filter, evaporate to syrup, add alcohol to precipitate amygdalin and gum, from which boiling alcohol takes up the former, depositing it upon cooling.

Emulsin (*synaptase*).—A ferment (enzyme) coagulated by heat, precipitated by alcohol, but not by acetic acid, and in the presence of water, acts upon amygdalin, forming glucose, $C_6H_{12}O_6$, hydrocyanic acid, HCN (1 part being formed from 17 of amygdalin), and benzaldehyde, C_7H_6O—oil of bitter almond 1–4 p. c.; $C_{20}H_{27}O_{11}N + 2H_2O = 2(C_6H_{12}O_6) + HCN + C_7H_6O$.

Oleum Amygdalæ Amaræ. Oil of Bitter Almond.—This volatile oil, like volatile oil of mustard, oil of gaultheria, and methyl salicylate,

does not preëxist in the kernels (seeds), but results from macerating with water for 12 hours the expressed cake of bitter almonds, wherein amygdalin undergoes fermentation, then distilling the oil formed by passing steam through the mixture; kernels of the peach (*P. Persica*) and apricot (*P. armeni'aca*) yield much of the commercial oil, which may also be prepared synthetically from toluene (see benzaldehydum, page 278). It is a clear, colorless, yellowish, strongly refractive liquid, characteristic odor and taste of benzaldehyde, soluble in alcohol, ether, slightly in water, forms clear solution in 70 p. c. alcohol (2); sp. gr. 1.038–1.060, optically inactive or dextrorotatory; at first neutral, but becomes acid from the formation of benzoic acid; yields not less than 85 p. c. of benzaldehyde, C_6H_5CHO, and 2–4 p. c. of hydrocyanic acid, HCN (sometimes as much as 8–10 p. c.); when freed from this latter it is less poisonous, but even then has a marked physiological action on the nervous system. *Impurities:* Nitrobenzene, chlorinated products, heavy metals. The label must indicate definitely its specific source, as this is intended for medicinal use, and not for flavoring foods. Should be kept dark, cool, in small, well-stoppered, completely filled, amber-colored bottles, and when showing crystals (benzoic acid) must not be dispensed. Dose, ♏$\frac{1}{4}$–1 (.016–.06 cc.).

FIG. 170.—*Amygdalus communis: 1*, flowering twig; *2*, twig, with fruit; *3*, fruit hull cracked off; *4*, seed deprived of hull; *5*, vertical section of flower; *6*, longitudinal section of seed.

FIG. 171.—*Amygdalus communis:* fruit in the act of opening.

PREPARATIONS.—OIL: 1. *Elixir Amygdalæ Compositum, N.F.*, $\frac{1}{20}$ p. c.: Preps.: 1. *Elixir Bromidorum Trium, N.F.*, q. s. 2. *Emulsa*—as flavoring when preferred. 3. *Spiritus Amygdalæ Amaræ, N.F.*, 1 p. c., Dose, ♏xv–30 (1–2 cc.). Preps.: 1. *Elixir Anisi, N.F.*, 1.2 p. c. 2. *Elixir Terpini Hydratis, N.F.*, ½ p. c.

Unoff. Preps.: Water (oil $\frac{1}{10}$ p. c.), ℥j–3 (4–12 cc.). *Syrup* (spt. of bitter almond 1, orange flower water 10, syrup q. s. 100), ℥ij–4 (8–15 cc.).

PROPERTIES.—Demulcent, nutrient, sedative; often produces urticaria.

USES.—Coughs, pulmonary troubles, flavoring.

Poisoning: Here have hydrocyanic acid symptoms; hence give emetics to induce vomiting, galvanism, brandy, whisky, ammonia to nostrils, etc.

Allied Products:

1. **Benzaldehydum. Benzaldehyde,** C_6H_5CHO, *U.S.P.*—(Syn., Benzald., Oleum Amygdalarum Æthereum (Artificiale)-sine Acide Prussico, Synthetic Oil of Bitter Almond; Fr. Aldehyde benzoique; Ger. Kunstliches Bittermandelöl.) An aldehyde produced synthetically or from oil of bitter almond, containing not less than 85 p. c. of benzaldehyde.

Manufacture: 1. Shake oil of bitter almond (peach, apricot, etc.) with concentrated solution of acid sodium sulphite (3) to form crystalline sodium benzalhydroxysulphonate, wash with cold alcohol, treat with strong sodium carbonate solution, rectify by distillation with steam. 2. Treat boiling toluene, C_7H_8, with chlorine, heat resulting benzyl chloride with barium nitrate and water, while passing carbon dioxide through the mixture, the benzyl nitrate formed decomposes into benzaldehyde and oxides of nitrogen. It is a colorless, yellowish, refractive liquid, bitter almond-like odor, burning aromatic taste, soluble in water (350), miscible with alcohol, ether, fixed or volatile oils; sp. gr. 1.045; differs from oil of bitter almond in having no hydrocyanic acid. *Tests:* 1. Shake .5 cc. with distilled water 5 cc., + sodium hydroxide T. S. .5 cc., + ferrous sulphate T. S. .1 cc., warm gently, + excess of hydrochloric acid—no greenish-blue color or blue precipitate within 15 minutes (abs. of hydrocyanic acid). 2. Dissolve 1 cc. in alcohol (20), + distilled water until turbid, evolve hydrogen 1 hour by adding zinc and diluted sulphuric acid, filter, evaporate to 20 cc.; of this boil 10 cc. + a drop of potassium dichromate T. S.—not violet (abs. of nitrobenzene). *Impurities:* Hydrocyanic acid, chlorinated compounds, nitrobenzene. Should be kept dark, in small, well-stoppered bottles. Dose, $\mathfrak{m}\frac{1}{4}$–1 (.016–.06 cc.).

Properties and Uses.—Similar to oil of bitter almond; largely as a flavoring agent, having the advantage of the oil in being devoid of hydrocyanic acid, and not being poisonous except in large quantities.

2. *Nitrobenzene, Nitrobenzol, Oil of Mirbane.*—False artificial oil of bitter almond is obtained by acting on benzene with nitric acid. It is very poisonous, has the true bitter almond oil odor, owing to which substitution has been made with fatal results; should not be taken internally—used for flavoring soaps, making aniline, etc.

AMYGDALA DULCIS. SWEET ALMOND.

Oleum Amygdalæ Expressum. Expressed Oil of Almond, *U.S.P.*

Amygdalus communis (var. **dulcis**), *Linné.* { A fixed oil obtained from the kernels of several varieties.

Habitat. W. Asia, Persia, Syria, Barbary, Morocco; naturalized in Mediterranean Basin; cultivated in Europe, S. California.

Syn. Jordon Almond, Malaga, Paper-shell, Greek Nuts; Fr. Amande(s) douce(s); Ger. Amygdalæ dulces, Susse Mandeln; Ol. Amygd. Exp., Oil of Sweet Almond, Oleum Amygdalæ Dulcis; Br. Oleum Amygdalæ, Almond Oil; Fr. Huile d'Amande (douce); Ger. Oleum Amygdalorum, Mandelöl.

Dul'cis. L. sweet—*i. e.*, the fruit without bitterness.

PLANT.—Small tree, 5–6 M. (15–20°) high, bark purplish; leaves bright green; flowers pale pink or white; fruit drupe, ovate, 5 Cm. (2′) long, 2.5 Cm. (1′) broad, sarcocarp green, leathery, splitting into two halves when ripe, and falling from the stone. This remaining stone is the commercial almond, and may be sold as such or may be bleached by sulphur dioxide, thereby also killing any attached insects. By cracking off hard shell the kernel, or, properly, the seed, is left, which, when deprived of papery endocarp by hot water, constitutes the more desirable blanched almond. Seed (almond), 17–25 Mm. ($\frac{3}{4}$–1′) long, 10–13 Mm. ($\frac{2}{5}$–$\frac{1}{2}$′) broad, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) thick, oblong-lanceolate; seed-coat light brown with numerous parallel veins, thin, easily removed by soaking in water; embryo straight, white, 2 plano-convex cotyledons; taste bland, sweet; triturated with water—milk-white, non-acid emulsion having no odor of benzaldehyde, or hydrocyanic acid (abs. of bitter almond). Powder, creamy-white—numerous small and large oil globules, crystalloids, globoids, fragments of parenchyma of endosperm and seed-coat, aleurone grains, spiral tracheæ; no starch grains.

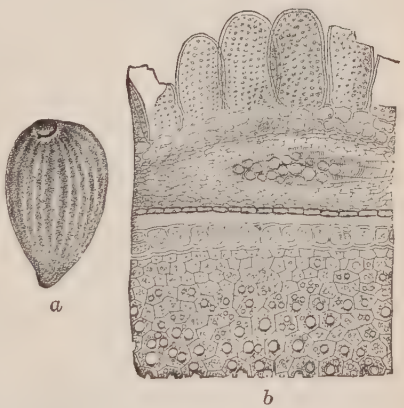


FIG. 172.—*Amygdalus communis: a*, seed-kernel; *b*, section through seed-coats and portion of cotyledon.

Commercial.—Of these there are several varieties (*Jordan, Valencia, Sicily, Barbary,* in the order of value), imported chiefly from Spain, S. France, via Marseilles or Bordeaux (*soft-shelled;* var. *frag'ilis*), and Malaga (*Jordan* or *long*) or Valencia (*hard-shelled*), being larger and longer than the var. *amara*, with more convex sides. The Jordan only, owing to easy recognition, are used in the Br. P. To preserve almonds, should keep dry, thereby preventing decomposition of amygdalin and fixed oil; when rancid the embryo has changed into gum bassorin, which renders them unfit for medicinal use.

CONSTITUENTS.—Fixed oil 56 p. c., Emulsin (mucilage 3 p. c., sugar 6 p. c., proteins (myosin, vitellin, and conglutin) 24–30 p. c., precipitated by acetic acid, ash 3–5 p. c.—K, Ca, Mg—phosphates); the *testa* of both varieties contain tannin.

DRUPACEÆ

Oleum Amygdalæ Expressum. Expressed Oil of Almond.—This fixed oil is obtained from both varieties of almonds (sweet and bitter) by grinding or bruising in an iron or stone mortar the clean and perfect kernels, enclosing mass in canvas bags and subjecting them to hydraulic pressure of 350 atmospheres between polished steel plates slightly heated (30° C.; 86° F.); the expressed turbid oil is set aside in a cool place, decanted from sediment and filtered; most of the commercial oil is from the bitter almonds prior to preparing the volatile oil. It is a clear, pale straw-colored, colorless, oily liquid, almost odorless, bland taste; slightly soluble in alcohol, miscible with ether, chloroform, benzene, petroleum benzin; sp. gr. 0.912; contains triolein 75–85 p. c., tripalmitin, trilinolein. *Tests:* 1. Clear at —10° C.; 14° F., congeals at —20° C.; —4° F. (abs. of olive, cottonseed, sesame, lard oils, congealing at —5° C.; 22° F., apricot and peach oils remaining fluid at —20° C.; —4° F.). 2. Shake vigorously oil (2), fuming nitric acid (1), distilled water (1)—the mixture is not more than colored (abs. of peach and apricot oils—red color, sesame and cottonseed oils—brown color). Should be kept cool, in well-closed containers. Dose, ʒj–2 (30–60 cc.).

Adulterations.—Olive, arachis (ground-nut), lard, cottonseed, sesame, poppy, apricot and peach oils; apricot kernels yield 25–38 p. c. of oil, which, with peach oil, is substituted often (in part or entire) for the pure article.

Preparations.—1. *Unguentum Aquæ Rosæ*, 56 p. c. 2. *Emulsum Petrolati, N.F.*, 22.5 p. c. 3. *Oleum Phosphoratum, N. F.*, 90 p. c. 4. *Unguentum Veratrinæ, N.F.*, 6 p. c.

Unoff. Preps.: Emulsion (seed 6 p. c., + acacia 1, sucrose 3, water q. s. 100), ʒij–4 (8–15 cc.). *Pulvis Amygdalæ Compositus* (Br.)—seed 60 parts, + sucrose 30, acacia 10.

Properties.—Demulcent, nutrient, laxative.

Uses.—The meal of the expressed cake as a toilet powder, and since it contains no starch it may readily be made into bread, cake, puddings, etc., which is excellent for diabetics. Seed very popular as a confection. Expressed oil, employed like olive oil, also for pulmonary trouble.

Allied Plants:

1. *Amygdalus* (*Prunus*) *Per'sica, Peach.*—Persia, cultivated largely in the United States, etc. Fruit edible, abounding in sugar, juice ferments, and upon distillation yields peach brandy; kernels poisonous from yielding HCN, often substituted for bitter almonds, also contain fixed oil resembling that of almond, for which it is an adulterant; leaves mild sedative in doses of gr. 15–30 (1–2 Gm.), in infusion.

2. *Cydo'nia* (*Py'rus*) *Cydonia, Quince.*—Pomaceæ. The seed; U.S.P. 1850–1880; W. Asia. Tree 2.5–6 M. (8–20°) high, with crooked, straggling branches; leaves like pear leaves; flowers white or purplish; fruit pear-shaped; seed 6 Mm. (¼′) long, ovate, triangular, brown, covered with whitish, mucilaginous, epithelium causing seed of each cell to adhere; swell with water, forming heavy mucilage; 2 cotyledons,

white, oily, bitter-almond taste; very similar to apple seed. Contain mucilage (cydonin) 20 p. c. (not precipitated by borax or potassium silicate, soluble in cold and hot water), fixed oil, proteins; used as demulcent, protective; fruit astringent. *Mucilago Cydonii* (1 part + water 50), U.S.P. 1880; may use rose water, or camphor water—externally.

3. *Ma'lus* (*Pyrus*) *Malus, Apple; Succus Pomorum, Fresh Apple Juice, N. F.*—The freshly expressed juice of sound, ripe, sour apples, the fruit of cultivated varieties. Plant resembles quince; fruit edible, laxative; bark tonic, febrifuge. Dose, gr. 15–60 (1–4 Gm.); 1. *Extractum Ferri Pomatum*, 100 p. c., dose, gr. 10–30 (.6–2 Gm.): Prep.: 1. *Tinctura Ferri Pomata*, 10 p. c., dose, ʒj–2 (4–8 cc.).

Fig. 173.—*Cydonia* (*Pyrus*) *Cydonia.*

Fig. 174.—*Malus* (*Pyrus*) *Malus.*

31. MIMOSACEÆ. Mimosa Family.

Mi-mo-sa'se-e. L. *Mimos-a* + aceæ, fr. L. *mimus*, Gr. μῖμος, a mimic—*i. e.*, the leaves often mimic or imitate animal sensibility, moving by slight impulse, partly closing when touched, etc. Herbs, shrubs, trees. Distinguished by leaves compound, 2–3 pinnate (sometimes phyllodia); calyx 3–6-toothed or lobed, corolla 3–6's, stamens distinct or monadelphous, ovary 1-celled, ovules several; fruit, legume; tropics, temperate climates; tonic, astringent, demulcent, nutritive, dye.

Genus: **1. Acacia.**

ACACIA. ACACIA, *U.S.P.*

Acacia Senegal, *Willdenow*, or some other species. { The dried, gummy exudation from the stems and branches, yielding not more than 1 p. c. of water-insoluble residue, nor 15 p. c. of moisture.

MIMOSACEÆ

Habitat. E. and W. Africa, Senegal, Kordofan, Egypt, Abyssinia, India, Nubia, Upper Nile.

Syn. Acac., Gum Arabic, Gum Senegal, Egyptian Thorn, Indian Gum Tree, Babla(c)h Pods, Acacia bambolah, Gummi Africanum or Mimosæ; Br. Acaciæ Gummi, Gum Acacia; Fr. Gomme arabique du Sénégal; Ger. Gummi arabicum, Arabisches Gummi.

A-ca'cia. L. fr. Gr. *ἀκακία*, a thorny Egyptian tree, fr. *ἀκή*, a point—*i. e.*, tree studded with thorns.

Sen'e-gal. L. belonging to Senegal, a country and river in W. Africa—*i. e.*, the plant's original and present habitat.

Ar'abic—misnomer, as Arabia produces little and exports none.

PLANT.—Shrubby tree, 6 M. (20°) high; stem tortuous with terete branches, nodes with 3 short, black-tipped spines subtending the leaves; bark smooth, grayish-brown; leaves alternate, bipinnate, paripinnate, 2.5–4 Cm. (1–1⅗′) long; pinnæ 3–5 pairs; leaflets sessile, 10–20 pairs, grayish-green, 4 Mm. (⅙′) long; flowers yellow, spikes; fruit (pod), loment, compressed, smooth, pale, 7.5–10 Cm. (3–4′) long, 18 Mm. (¾′) broad, 2–6-seeded. GUM (acacia), in spheroidal tears, angular fragments up to 32 Mm. (1⅖′) in diameter, yellowish-white, light-amber, translucent, brittle; fracture glassy, sometimes iridescent; almost odorless; taste mucilaginous; insoluble in alcohol, slowly and almost completely soluble in water (2), forming mucilaginous liquid of slight, characteristic odor and acid reaction. POWDER, whitish—in angular microscopic fragments with but slight traces of starch or vegetable tissue. *Tests:* 1. Aqueous solution (1 in 10) 10 cc., + basic lead acetate T. S. (.2)—gelatinous precipitate. 2. With iodine T. S.—not blue (abs. of starch), nor red (abs. of dextrin). 3. Aqueous solution (2 p. c.) 10 cc. + ferric chloride T. S. .1 cc.—no blackish coloration or blackish precipitate (abs. of tannin-bearing gums). Dose, *ad libitum.*

ADULTERATIONS.—GUM: Inferior, dark colored, opaque and insoluble gums, bdellium, rock salt, ligneous and earthy substances, sand, dirt, dextrin in lumps; POWDER: Flour, rice flour, starch, dextrin—all recognized by solubility, viscosity, the microscope, and iodine test. The gum from quince seed, flaxseed, Irish moss, etc., often used as a substitute.

Commercial.—Plants grow associated with little other vegetation in sandy soil, deserts, forming entire forests. Gum, a degenerative product, the result of "gummosis"—transformation of cell contents (cellulose) in the cambium, cortex, and adjacent parenchyma, a process favored in dry hot seasons and unhealthy trees—exudes as a thick juice through fissures caused by dry winds after the rainy season, or artificial incisions, and sooner or later, whereby depends color, hardens on the bark similar to our cherry, apple, or plum gum. It is collected Oct.–Dec., some in March, by the Moors and negroes, who in caravans enter the acacia forests and gather it in leather sacks, detaching adherent lumps with wooden axes and picking up fallen pieces from the ground. It enters market in bags, boxes, casks, skins, mostly from Egypt, via Cairo, Alexandria, Trieste, where it is received as unas-

sorted acacia, "acacia in sorts"—the aggregated product of various species, assorted into "first picked," "second picked," etc., down to sorts (unworthy of assorting)—there being recognized at Trieste thirty-two grades. Acacia is known by the natives as *Verek* (Senegal) or *Hashabi* (E. Africa), the best being white, opaque, and chiefly from *A. Senegal* (*Ve'rek*) and *A. arabica* (*vera*), which grow promiscuously with other species and contribute the several varieties: 1, *Turkey* (*Arabian, Egyptian*), which includes (*a*) Kordofan (*A. Senegal, A. Verek*), from west of White Nile, once constituting the bulk of the superior gum, (*b*) Sennaar (*A. fis'tula, A. stenocar'pa*), from east of

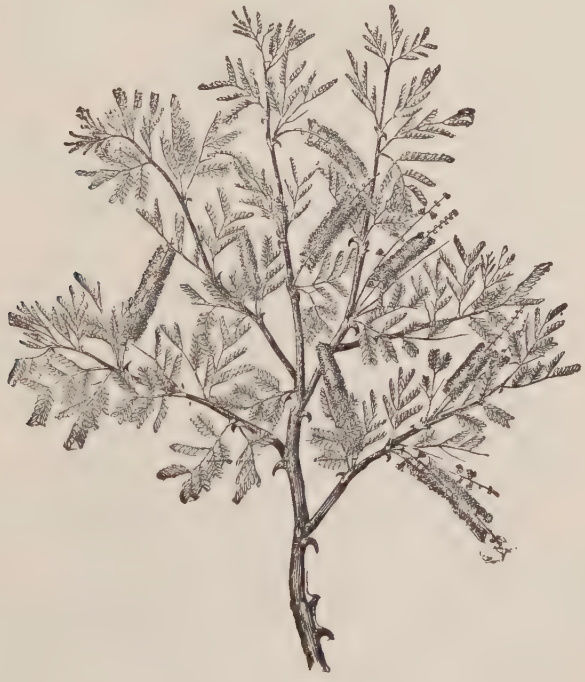


FIG. 175.—*Acacia Senegal.*

White Nile, inferior, mucilage sours quickly, (*c*) Suakin (Talca—*A. stenocarpa, A. Se'yal*), from near Red Sea, mixture of white and brown pieces, very brittle, usually semi-pulverulent, only soluble with alkali; 2, *Senegal* (*A. Senegal*), from north of Senegal River, W. Africa, being controlled by France and shipped to Bordeaux; larger than Turkey gum, some nodules the size of a pigeon egg, less brittle, more yellow or reddish, with fewer cracks and more conchoidal fracture, not amber-yellow when heated with potassium hydroxide, as are Turkey gum and dextrin solutions; 3, *Barbary* (*Morocco, Mogador—A. nilot'ica, A. arabica*), collected July–August, consisting of two kinds that enter Mogador, one from Morocco (resembling Turkey), the other from Tim-

buctoo (resembling Senegal), both in more or less brownish, roundish tears, brittle, soluble in water; 4, *India* (*Persian—A. arabica*, +), from Somali districts, E. Africa, conveyed by Arab vessels to Bombay; resembles somewhat Turkey and Senegal gums, however, much mixed and often containing Bassora gum or allied substances (insoluble, swelling and softening with water into viscid mass), also resinous products resembling turpentines; deprived of these the variety is well suited for general use.

Gums are produced also by other *Acacia* species in Morocco, Cape Colony, Australia (Wattle gum), Brazil (Para, Angico gum), etc.; Mesquite gum (*Proso'pis julifło'ra*), Texas, California, New Mexico, Chile, resembles acacia, but is yellow, brown, and not precipitated by lead subacetate, ferric chloride, borax; also considerable gum from plants of different genera and family, darker color but resembling the official.

Powdered acacia occurs in two forms: 1, *Granulated* (*sanded*), produced by heating the gum until deprived of 2 p. c. of moisture; 2, *Finely powdered* (*dusted*), produced by heating the gum until deprived of 10 p. c. of moisture—a process rendering it more lumpy and less soluble in water.

CONSTITUENTS.—Arabic acid, $C_{12}H_{22}O_{11}$, combined with Ca, Mg, K —arabates; sugar (trace), moisture 14 p. c., ash 3–4 p. c.

Arabic Acid (*gummic acid*, *arabin*).—A glucoside obtained by adding alcohol to acidified (HCl) mucilage. After drying, it swells with water, but dissolves only upon the addition of an alkali, boiled with acids yields arabinose (arabin sugar, pectinose, pectin sugar), $C_5H_{10}O_5$, in prismatic crystals, sweet, but not directly fermentable, and possibly also galactose, granular and less sweet.

PREPARATIONS.—1. *Mucilago Acaciæ*. Mucilage of Acacia. (Syn., Mucil. Acac., Mucilage of Gum Arabic; Fr. Mucilage de Gomme; Ger. Mucilago Gummi arabici, Gummischleim.)

Manufacture: 35 p. c. Wash acacia 35 Gm. in a tared bottle (flask) with sufficient cold water, discard washings, drain, add warm distilled water, in which sodium benzoate .1 Gm. has been dissolved, q. s. 100 cc.; after corking, lay bottle on its side, rotating it occasionally, and when acacia dissolved, strain mucilage. Must be made frequently and not dispensed if sour or moldy. When cold or hot water employed alone acetic acid is formed from the acid calcium arabate, which may be neutralized by lime water (35 p. c.), or retarded by sodium benzoate ($\frac{1}{1000}$ p. c.), alcohol (6 p. c.), glycerin (10 p. c.), acetanilid (.4 p. c.), or chloroform (.5 p. c.). Dose, *ad libitum*.

2. *Emulsum Olei Morrhuæ*, 12.5 p. c. 3. *Emulsum Olei Terebinthinæ*, 5 p. c. 4. *Pilulæ Phosphori*, $\frac{1}{2}$ gr. (.03 Gm.). 5. *Pulvis Cretæ Compositus*, 20 p. c. 6. *Emulsum Olei Morrhuæ cum Hypophosphitibus*, *N.F.*, 12.5 p. c. 7. *Emulsum Olei Ricini*, *N.F.*, 9 p. c. 8. *Emulsum Petrolati*, *N.F.*, 12.5 p. c. 9. *Mistura Copaibæ*, *N.F.*, 3.5 p. c. 10. *Mistura Copaibæ et Opii*, *N.F.*, 6.5 p. c. 11. *Pilulæ Ferri Iodidi*, *N.F.*, $\frac{1}{6}$ gr. (.01 Gm.). 12. *Trochisci Eucalypti Gummi*, *N.F.*, 2 gr. (.13 Gm.).

Unoff. Preps.: Syrup, 10 p. c., + sucrose 80, distilled water q. s. 100. *Emulsions, Pills, Troches*, etc.

PROPERTIES.—Demulcent, emollient, protective, nitritive. Forms often the food of Hottentots and camels. By its viscidity sheaths inflamed surfaces; as a diluent, lessens acrimony of irritating medicines.

FIG. 176.—*Acacia arabica.*

USES.—Coughs, laryngitis, gastritis, typhoid fever, dysentery, diarrhea. Fine powder locally stops slight hemorrhage; thick mucilage protects burns, ulcers, etc. In pharmacy used to suspend insoluble substances in water—emulsifying oleoresins, fixed and volatile oils, for adhering pills, troches, etc; in arts for giving luster to fabrics, silks, thickening colors, mordants, suspending iron tannate in ink, etc. The bark of tree for dyeing, tanning, as it contains tannic and gallic acids.

MIMOSACEÆ

Allied Plants:

1. *Acacia Cat'echu, Catechu; Catechu Nigrum* (Br.).—An extract prepared from the heart-wood, U.S.P. 1820–1890; India, Hindustan. Plant crooked, shrubby tree, 4.5–12 M. (15–40°) high, 15–45 Cm. (6–18′) thick, bark brown, wood whitish and reddish, leaves paripinnate, pinnæ in 10-20 pairs, with a pair of hooked, brown prickles at each base, leaflets 20–30 pairs in each pinna, flowers yellow, fruit,

FIG. 177.—*Acacia Catechu.*

pod (loment), brown, flat, 5–12.5 Cm. (2–5′) long, seed 3–10, brown, shining; extract (catechu) in irregular masses, dark brown, brittle, porous, fracture conchoidal, little glossy, inodorous, taste sweetish, astringent. It is prepared by removing bark and sapwood, and boiling in water, for about 12 hours, the reddish-black heart-wood, cut in chips, straining, evaporating, stirring frequently and vigorously to improve the product—over-boiling being injurious, as it converts catechin into

catechu-tannic acid; when of syrupy consistency it is cooled somewhat and poured into clay molds or on leaves, mats, etc., previously dusted with cow-dung ashes; by morning it is hard, brittle, when it is broken up into suitable pieces for market; contains catechu-tannic acid 35 p. c., catechin 13–34 p. c., quercetin, gum, extractive. There are several varieties: 1, Plano-convex (Cake); 2, Pegu; 3, Quadrangular (Cake), Bengal; 4, Ball, Bombay. *Adulterations:* Largely with leaves, mats, cloths, sticks, sand, dried blood, ashes, clay, starch, ferrous carbonate, sometimes to 65 p. c.; artificial variety made from roasted mahogany, walnut, etc. Astringent, tonic, similar to tannic acid—much more harsh than gambir, owing to which it is used chiefly for tanning, arts, etc.; diarrhea, leucorrhea, gonorrhea, chronic sore throat, relaxed uvula, spongy gums (mouth wash), hemorrhages, bronchitis. Dose, gr. 5–30 (.3–2 Gm.); compound tincture, 10 p. c. (diluted alcohol), dose, ʒss–2 (2–8 cc.); fluidextract; infusion. *A. arabica* (*vera*) and *A. decur'rens*, bark (*Acacia Cortex*—Br.) rusty-brown, blackish, striated, spines and fruit long; contains tannin, mucilage: *Decoctum*, 6 p. c.; *A. gummif'era*, *A. Ehrenbergia'na*, *A. Adanso'nii*, *A. tor'tilis*, *A. Fis'tula*, and several others give valuable gums. *A. Su'ma* differs from *A. Catechu* only in its white bark, more leaflets, shorter corolla, and stronger spines; S. India, E. Africa (forests), S. America once furnished most of the commercial catechu, and still some; the bark used in tanning. *A. arabica, Babul Bark*, India; furnishes good extract; the fruit contains tannin 22 p. c.

2. *Ar'eca Cat'echu, Areca* or *Betel Nut.*—Palmaceæ (see page 100). Palm tree cultivated in India. Extract made by evaporating decoction of the powdered nuts.

32. CÆSALPINIACEÆ. Senna Family.

Ses-al-pin'i-a'se-e. L. *Cæsalpin-us*(*-i*) + aceæ, after Andreas Cæsalpinus (1519–1603), a noted Italian botanist and physician. Trees, herbs, shrubs. Distinguished by leaves compound, bipinnate, stipulate, stems often prickly; flowers yellow, red, calyx 5's, petals 5, upper one enclosed by lateral ones in bud; fruit legume, dehiscent; tropics; astringent, cathartic, tonic, diuretic, dye.

Genera: **1. Copaiba. 2. Cassia (Cathartocarpus).**

COPAIBA. COPAIBA, *U.S.P.*

Copaiba, *Miller,* one or more S. American species. } An oleoresin.

Habitat. Brazil (Venezuela, Colombia), Amazon valley, banks of the Orinoco River.

Syn. Copaib., Balsam of Copaiba, Copaiva, Balsam Capivi; Fr. Copahu, Oleo-résine (Baume) de Copahu; Ger. Balsamum Copaivæ, Copaivabalsam.

Co-pai'ba. L., Sp., and Port., fr. Brazil. *cupauba—i. e.*, native name of the tree and its product.

CÆSALPINIACEÆ

PLANT.—Handsome tree, 4.5–18 M. (15–60°) high, much branched, bark brown, rather smooth; leaves alternate, paripinnate; leaflets opposite, 3–5 pairs, 2.5–5 Cm. (1–2′) long, ovate, entire, glabrous, coriaceous, pellucid-punctate; flowers small, white; sepals 5; apetalous; stamens 10; pod small, 2.5 Cm. (1′) long, orange-brown, dehiscent into 2 valves, 1-seeded. OLEORESIN (copaiba), pale yellow, brownish-yellow, viscid liquid, without fluorescence or with only slightly greenish fluorescence; odor peculiar, aromatic; taste persistent, bitter, acrid; soluble in chloroform, ether, carbon disulphide, fixed or volatile oils, petroleum benzin (1), any addition producing a flocculent precipitate, partly soluble in alcohol, more completely in dehydrated alcohol, insoluble in water; sp. gr. 0.940–0.995. *Tests:* 1. Heat 2 Gm. on water-bath—no odor of oil of turpentine, and residual resin should be hard, brittle, and weigh 36 p. c. of original copaiba taken (abs. of oil of turpentine, paraffin, fatty oils). 2. Float 3–4 drops of oil of copaiba on a mixture (nitric acid 1 drop + glacial acetic acid 3 cc.)—no reddish zone; shake, no reddish or purple liquid (abs. of gurjun balsam). 3. Shake 5 cc. + 15 cc. alcohol, boil 1 minute, cool—no oil separates after standing 1 hour (abs. of paraffin oils). 4. Not over 5 p. c. insoluble in dehydrated alcohol. Dose, ♏x–60 (.6–4 cc.).

ADULTERATIONS.—OLEORESIN: Those of allied species, that partially deprived of oil, oil of turpentine, volatile oils, rosin, rosin oil, paraffin, paraffin oils, fatty oils (linseed, castor, etc.), Venice turpentine, African copaiba, gurjun balsam, alcohol—often evinced through different odors on slowly heating. OIL: Gurjun balsam oil, increasing specific gravity, African copaiba oil—insoluble in equal volume of alcohol.

Commercial.—Much was written concerning copaiba during 1625–1638, but Marcgrav and Piso first described its collection, also the tree, 1648; Jacquin studied the genus, 1760, as did Desfontaines some years later, while Hayne, 1827, Bentham, 1870, Baillon, 1877, separated by the varying foliage 11 species in Brazil alone, all having similar flowers, fruit, and valuable, hard, strong, tough, durable wood. However, most of copaiba comes from 7 species: Brazil—*C. Langsdorf'fii, C. confertiflo'ra, C. coria'cea, C. oblongifo'lia;* N. W. Orinoco Valley—*C. officina'lis;* Amazonian region—*C. guianen'sis, C. multiju'ga.* It is a pathogenic product, possibly an antiseptic protective, occurring in schizogenic ducts (cavities differing greatly in size), from which it is obtained by making large auger holes or boxes, square or wedge-shape, into the center of the tree, near the base, whence it usually flows at once, demanding alertness to avoid loss, often giving 12 pounds (5.5 Kg.) in 3 hours; if none should appear the aperture is closed with clay or wax and reopened in 2 weeks, when, as a rule, the discharge is abundant. The flow at first is thin, clear, colorless, but soon becomes thicker and yellowish, as it does also with age. A tree may yield 10–12 gallons (38–45 L.), in 2–3 annual flows, and when abandoned, the ducts, some the length of the stem, occasionally fill and, acting as high liquid columns, furnish sufficient pressure to burst

the trunk with a cannon-like report. It is exported in casks, demijohns, cans, jugs, the value depending upon the amount of contained volatile oil. There are several varieties: 1, *Para*, most limpid, palest; contains volatile oil 60–90 p. c.; 2, *Maranham*, denser, consistence of olive oil, odor slightly different; contains volatile oil 40–60 (rarely 80) p. c.; 3, *Rio Janeiro*, resembles closely the Maranham—these three (Brazilian) form clear mixtures with one-third to one-half their weight of ammonia water, but milky if more alkali or fixed oil present; 4, *Surinam* (*C. guianensis*), rather thin, light yellow, soluble in ether, chloroform, alcohol (4–5 parts, turbid with equal portion), violet with bromine (1) + chloroform (20); contains volatile oil 70–80 p. c.; 5, *Maracaibo*, the thickest, turbid, dark yellow; solidifies with magnesium oxide, not clear with ammonia water; contains volatile oil 20–40 p. c., and owing to large amount of resin is well adapted for Massa Copaibæ, *N.F.*, as it combines with magnesium oxide forming resin soap, which gradually becomes dry and hard; Para and other varieties may

FIG. 178.—*Copaiba Langsdorffii.*

be used but sufficient volatile oil must be evaporated to render residue viscid upon cooling. Copaiba is exported not only from the above ports, but also from Angostura, Cayenne, W. Indies, Trinidad, C. America, etc.

CONSTITUENTS.—Volatile oil, Resin, bitter principle, copaivic acid, $C_{20}H_{32}O_2$ (oxycopaivic acid, $C_{20}H_{28}O_3$, from Para, metacopaivic acid, $C_{22}H_{34}O_4$, from Maracaibo—all three acids crystalline). Has no benzoic or cinnamic acid, hence the name balsam is misapplied.

Oleum Copaibæ. Oil of Copaiba, $C_{15}H_{24}$ (Br.—U.S.P. 1850–1900).—This volatile oil is distilled from copaiba with water or steam, and upon it most of the medicinal properties of the oleoresin depend. It is a pale yellowish liquid, oxidizing by exposure, characteristic odor of copaiba, aromatic, bitter, pungent taste; consists chiefly of caryophyllene, $C_{15}H_{24}$; sp. gr. 0.900, increasing with age; soluble in 2 volumes alcohol; that from Maracaibo dark blue with hydrochloric acid gas. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏v–15 (.3–1 cc.), in emulsion, capsule, or on sugar.

Resina Copaibæ. Resin of Copaiba.—(Acidum Copaibicum). The residue left after distilling off the volatile oil from copaiba. It is brownish-yellow, brittle, slight odor and taste of copaiba, to which the resin returns when mixed with the volatile oil of copaiba; soluble in alcohol, ether, chloroform, benzene, volatile oils; contains copaivic, or metacopaivic acid, mixed with neutral resin. Dose, gr. 5–15 (.3–1 Gm.).

PREPARATIONS.—1. *Massa Copaibæ, Solidified Copaiba, N.F.,* 94 p. c. + magnesium oxide 6 p. c., water q. s. to dampen, heat. Dose, gr. 15–30 (1–2 Gm.). 2. *Mistura Copaibæ, Lafayette Mixture, N.F.,* 12.5 p. c. 3. *Mistura Copaibæ et Opii, Chapman's Mixture, N.F.,* 25 p. c. + tinct. opii 3.2, sp. æth. nitrit. 25, +. Dose, ʒj–2 (4–8 cc.).

Unoff. Preps.: Capsules. Emulsion. Electuary. Pills. Suppositories.

PROPERTIES.—Similar to turpentine; diuretic, stimulant, expectorant, laxative, nauseant, disinfectant; acts mainly on the mucous membranes (genito-urinary), by which, and also skin, it is eliminated; increases quantity as well as solids of the urine, and imparts odor to urine, sweat, milk, breath; sometimes erupts the skin—roseola, urticaria, etc.

USES.—Gonorrhea, cystitis, bronchitis, dysentery, diarrhea, hemorrhoids, psoriasis, dropsy, leprosy; volatile oil is not so valuable for gonorrhea, gleet, etc., as the oleoresin, but better for throat affections. Externally—chilblains, sore nipples, anal fissures, often added to varnishes and *vice versa*. Long usage may cause indigestion and renal irritation.

Poisoning, Incompatibles, Synergists: Same as for turpentine.

Allied Products:

1. *Copaiba Mar'tii, C. cordifo'lia, C. Jus'sieui, C. Jac'quini, C. nit'ida*—all furnish oleoresin, usually poor in the amount of volatile oil.

2. *Hardwick'ia pinna'ta.*—E. India. Tree yields dark brown oleoresin, containing volatile oil 20–40 p. c., resin, no copaivic acid.

3. *Dipterocar'pus ala'tus.*—India. Tree yields gurjun balsam or wood oil—an oleoresin resembling copaiba, containing gurjunic (metacopaivic) acid.

4. *Copal, Gum Copal.*—A fossil resin of Zanzibar or exuding from many leguminous plants of Africa, S. America, W. Indies. Occurs in yellowish-brown masses, wrinkled surface, conchoidal fracture, glossy, odorless, tasteless; when melted becomes soluble in alcohol, ether, and oil of turpentine. Same medicinal properties as copaiba, only weaker; used mainly in preparing varnishes.

Allied Plants:

1. *Tamarin'dus in'dica, Tamarindus, Tamarind, N.F.*—The partially dried ripe fruit, deprived of the brittle outer portion of the pericarp and preserved in sugar (sucrose) or syrup, containing not more than 2 p. c. of foreign organic matter; India, Africa, nat. in W. Indies.

Fig. 179.—*Tamarindus indica.*

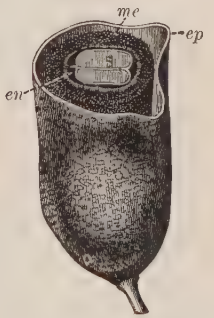


Fig. 180. — Tamarind fruit: cross-section: *ep*, epicarp; *me*, mesocarp; *en*, endocarp; *s*, seed.

Handsome tree, 18–24 M. (60–80°) high; bark rough, ash color; leaves paripinnate, leaflets 8–16 pairs, sessile, 12–25 Mm. ($\frac{1}{2}$–1′) long, 6 Mm. ($\frac{1}{4}$′) broad; flowers yellow, racemes; fruit indehiscent legume, compressed, 7.5–15 Cm. (3–6′) long, 2.5 Cm. (1′) broad, curved, nearly smooth, yellowish-brown, pericarp thin, brittle, corky. Pulp—a pulpy mass, light reddish-brown, darker with age, containing some branching fibers and numerous reddish-brown, smooth, oblong, quadrangular, compressed seed, each in a tough membrane; pulp with parenchyma cells containing few starch grains, calcium oxalate rosettes and crystal-fibers with prisms; odor distinct; taste sweet, agreeably acid. Bright iron in contact with moist pulp 30 minutes should not show reddish deposit (abs. of copper from evaporating vessels). There are three varieties: 1, W. Indian (Brown, Red), the once official kind, cakes kneaded with sugar or hot syrup, or alternate layers of pulp and sugar; 2, E. Indian (Black), masses simply pressed together and dried in the

sun; 3, Egyptian, cakes, flat, round, black, acrid, often moldy; contains tartaric acid 5–9 p. c., citric acid 4–6 p. c., potassium bitartrate 5–6 p. c., malic acid, acetic acid (mostly as potassium salts), sugar, pectin, tannin (in seed testa), insoluble matter 12–20 p. c. Laxative, refrigerant; febrile diseases, combined with other laxatives (senna, etc.) as a flavoring. Dose, ʒss–5 (2–20 Gm.); 1. *Confectio Sennæ*, 10 p. c.

2. *Erythrophlœ'um guineen'se, Sassy, Mancona,* or *Ordeal Bark.*—The dried bark; W. and C. Africa. Large tree with spreading branches, doubly pinnated leaves. Bark flat or curved, 5 Mm. ($\frac{1}{5}'$) thick, warty, fissured, hard, dull red with whitish spots, brittle, transverse cut shows fawn-colored spots, inodorous, astringent; contains erythrophlœine (heart tonic, anesthetic, poisonous), manconine, tannin. Cardiac tonic, local anesthetic, astringent, diaphoretic, narcotic, sternutatory; occasions slow, strong pulse. Dose of erythrophlœine hydrochloride, gr. $\frac{1}{32}$–$\frac{1}{16}$ (.002–.004 Gm.).

SENNA. SENNA, *U.S.P.*

Cassia { **Senna,** *Linné,* **angustifolia,** *Vahl.* } { The dried leaflets, with not more than 10 p. c. of stems, nor 2 p. c. of pods or other foreign organic matter, yielding not more than 3 p. c. of acid-insoluble ash.

'*Habitat.* E. and C. Africa, India.

Syn. Senn.; Br. Sennæ Folia, Senna Leaves: 1. Senna Alexandrina, Alexandrian (Nubian, Tripoli) Senna; Fr. Séné—d'Alexandrie; Ger. Alexandrinische Senna. 2. Senna Indica, East Indian (Arabian, Bombay, Mecca, Mocha, Tinnevelly) Senna; Fr. Séné de l'Inde—de Tinnevelly, Feuilles de Séné; Ger. Folia Sennæ, Sennesblätter, Indische Senna.

Cas'si-a. L. fr. Gr. κασσία, κασία, fr. Heb. *qetsi-oth, qatsa,* to cut off, to peel off—*i. e.*, bark of some species cut off and used; classical name of a bark allied to cinnamon.

Sen'na. L. fr. Ar. *sana, sena.* Hind, *sena*—*i. e.*, native Arabian plant name; this is the subgenus of *Cassia*, but should have held full generic rank.

An-gus-ti-fo'li-a. L. *angustus,* narrow, + *folium,* leaf—*i. e.*, leaves narrow.

PLANTS.—*Cassia Senna*, small shrub, .6–1 M. (2–3°) high; stem erect, woody, branching, whitish; flowers large, yellow, axillary raceme; fruit few, legume, 5 Cm. (2′) long, 18 Mm. ($\frac{3}{4}'$) broad, thin, broadly elliptical, reniform, dark green, membranous, smooth, indehiscent, 6–7-celled, each with a cordate, ash-colored seed; leaves alternate, 4–5 pairs, paripinnate, footstalks glandless, 2 small-pointed stipules at base; *Cassia angustifolia*, small shrub similar to preceding, except fruit a trifle longer and narrower, 8-seeded; leaves sessile, 5–8 pairs. LEAFLETS (*C. Senna*): *Alexandria*, 2–3.5 Cm. ($\frac{4}{5}$–$1\frac{2}{5}'$) long, 6–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}'$) broad, inequilaterally lanceolate, lance-ovate, short, stout petiolules, acutely cuspidate, entire, subcoriaceous, brittle, pale grayish-green; hairs short, appressed, few on upper surface more numerous on lower, spreading on the midrib; usually unbroken, occasionally in fragments; odor characteristic; taste mucilaginous, bitter; (*C. angusti-*

folia): *Tinnevelly*, 2–5 Cm. ($\frac{4}{5}$–2′) long, 6–15 Mm. ($\frac{1}{4}$–$\frac{3}{5}$′) broad, yellowish-green, smooth above, paler beneath, slightly hairy, more abruptly pointed than, but odor and taste resembling closely the preceding. POWDER, light green—fragments of veins with lignified tracheæ and crystal-fibers, isolated hairs, masses of palisade and mesophyll parenchyma, stomata, calcium oxalate rosettes, prisms; hairs more numerous in *C. Senna*. *Tests:* 1. Boil for 2 minutes .5 Gm. with

FIG. 181.—*Cassia Senna:* half natural size; *A*, leaflets; *B*, legumes.

alcoholic solution of potassium hydroxide (1 in 10) 10 cc., add water 10 cc., acidify filtrate with hydrochloric acid, shake with ether, then shake the ethereal layer with ammonia T. S. 5 cc.—latter pinkish-, bluish-red color. *Solvents:* water or diluted alcohol extracts the active constituents (*emodin, chrysophanic acid*); water-soluble constituents 28 p. c.; a decoction made by long boiling is inert, being rendered more so by the addition of an alkali or acid; leaves by percolation with alcohol

are deprived of their griping (resinous) content, odor, taste, and color, but still retain, slightly lessened, their pleasant cathartic power. Dose, ʒss–3 (2–12 Gm.).

Adulterations.—*Alexandria:* 1. *C. obovata*, leaflets, called by Arabs *Senna Baladi* (Wild Senna), and considered in Egypt less valuable than *Senna Jebeli* (Mountain Senna, *C. Senna*). 2. *Solenostem'ma Ar'gel*, leaves which have lateral veins indistinct, leathery, wrinkled, bitter; flower buds present; fruit pear-shaped. 3. *Crac'ca* (*Tephro'sia*) *Apollin'ea*, leaflets, S. Europe, uneven base, obovate, emarginate (poisonous). 4. *Coria'ria myrtifo'lia*, leaves (poisonous), and *Colu'tea arbores'cens*, leaflets formerly used. 5. Leaves of *Ailan'thus glandulo'sa*, *Tree of Heaven*, easily recognized, even in the powder. 6. *Pods, leaf-stalks, branches.* All these now are garbled out carefully. The Arabians preferred the pods, as they contain 25 p. c. more cathartic principle than the leaflets, and no resin or volatile oil, hence do not gripe. Six or eight pods infused in ʒij (60 cc.) of water will purge an adult.

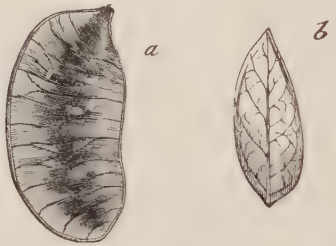


Fig. 182.—*Cassia Senna: a*, legume; *b*, leaflet, about natural size.

Commercial.—Plants yield two annual crops of leaflets, the larger (best) in September, at the end of the rains, the smaller in April, during the dry season; the entire plants are cut down (by natives), exposed on rocks to the hot sun until dry, stripped of leaflets, which are packed in palm-leaf bags for transportation on camels to the market ports, where, after being garbled, the drug is put into large bales for exportation. There are several varieties: 1. *Alexandrian* (*Nubian*), chiefly from Nubia (Sennaar, Kordofan), some from Timbuctoo, being forwarded usually via Assouan, Darao, thence by the Nile to Cairo and Alexandria; its botanic source has received various synonyms: *Cassia Senna, C. acutifolia, C. lanceola'ta, C. leniti'va, C. officinalis, C. æthio'pica, C. orientalis*, etc.; *Tripoli senna*, from Tripoli (interior Africa), having no doubt the same botanic origin, is conveyed to market ports by caravans, being, as a rule, much broken, discolored, and mixed with legumes, stalks, and earthy matter, but no foreign leaves, and seldom reaches our country; it is restricted by some to *C. æthiopica* (*C. obovata, C. ova'ta*), and is not grown in Arabia or India. 2, *Tinnevelly* (*Indian, Arabian, Mocha*), originally indigenous to S. Arabia and interior of Africa, but entered market via India (Bom-

bay, Calcutta); its botanic source has received several synonyms: *Cassia angustifolia, C. elonga'ta, C. med'ica;* now cultivated extensively, from Arabian seeds, at Tinnevelly, S. India, where it becomes most luxuriant; and owing to freedom from legumes, stalks, etc., furnishes the finest and purest leaflets; it is exported mostly from Tuticorin, and Madras; *Bombay (E. India) Senna*, sold frequently as Tinnevelly, has the same source, but is dried less carefully, often con-

FIG. 183.—*Cassia angustifolia:* half natural size; *A*, leaflets; *B*, legumes.

taining small and discolored leaflets; *Arabian (Mecca) Senna*, sold often as Bombay, is collected and dried even with less care, and contains many brown leaflets and legumes.

CONSTITUENTS.—Anthraglucosennin, Emodin 1 p. c., Chrysophanic acid, Glucosennin, Isoemodin, Senna-rhamnetin, Sennanigrin, Kaempferol Kempferin, gum, resin, catharto-mannite (non-fermentable sugar), isomeric with quercite, sennapicrin, oxalic, malic, tartaric acids,

combined with calcium, volatile oil (developing after drying), ash 10–12 p. c., of which 3 p. c. is insoluble in hydrochloric acid.

Anthraglucosennin.—Obtained (Tschirch) by evaporating a weak ammoniacal percolate of senna; it is a complex brownish-black powder, partly soluble in ether, acetone, capable of being resolved into components by various solvents; the ether-soluble portion (emodin, chrysophanic acid, glucosennin) when boiled with toluene, to a partial solution, and poured into benzin gives a precipitate—*(senna-)emodin*—trioxymethylanthraquinone, melting at 223° C. (434° F.), while in the benzin mother-liquor remains—*(senna-)chrysophanic acid*—dioxymethylanthraquinone, obtained by evaporation; the ether-soluble portion insoluble in toluene is an emodin glucoside—*glucosennin*, $C_{22}H_{18}O_8$ (yellow amorphous powder). The ether-insoluble portion (isoemodin, senna-rhamnetin) when treated with acetone and shaken with benzin yields—*(senna-)isoemodin*, $C_{15}H_{10}O_5$ (isomeric with (senna-)emodin, but differs in being soluble in benzin); the acetone

FIG. 184.—*Cassia angustifolia: a*, legume; *b*, leaflet, about natural size.

FIG. 185.—Argel leaf.

FIG. 186.—Coriaria leaf.

FIG. 187.—Cracca (Tephrosia) leaflet.

solution retains—*senna-rhamnetin* (reddish-brown powder, differing from rhamnetin in not fluorescing in sulphuric acid solution); the anthraglucosennin residue left after treatment with ether and acetone is a black, amorphous powder, which treated with alcoholic potash yields—(senna-)emodin and (senna-)chrysophanic acid. From an aqueous percolate Tschirch extracted cathartic acid and a crystalline body, $C_{14}H_{10}O_5$, having similar reactions as sennanigrin, but concludes that the cathartic action (peristalsis) is due solely to the emodin and chrysophanic acid, both being oxymethylanthraquinones. Formerly senna was believed to contain: cathartic (cathartinic) acid, sennapicrin, sennacrol (resin causing griping), chrysophan and pheretin (yellow coloring matters), sennite (cathartomannite), mucilage, ash 10–12 p. c.

PREPARATIONS.—1. *Fluidextractum Sennæ.* Fluidextract of Senna. (Syn., Fldext. Senn., Fluid Extract of Senna; Liquor Sennæ Concentratus; Fr. Extrait fluide de Séné; Ger. Sennafluidextrakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126; menstruum: 33 p. c. alcohol, reserving first 80 cc. Dose, ʒss–2 (2–8 cc.).

Preps.: 1. *Syrupus Sennæ.* Syrup of Senna. (Syn., Syr. Senn.; Fr. Sirop de Séné; Ger. Sirupus Sennæ, Sennasirup.)

Manufacture: 25 p. c. Mix oil of coriander .5 cc. with fldext. of senna 25, gradually add water 33, let stand 24 hours in cool place, shaking occasionally, filter, pass through filter water q. s. 58 cc., in which dissolve sucrose 63.5 Gm., add water q. s. 100 cc. Dose, ʒss–4 (2–15 cc.).

2. *Syrupus Sennæ Aromaticus, N.F.*, 12.5 p. c., + jalap 5, rhubarb 1.75, +. Dose, ʒj–3 (4–12 cc.). 3. *Syrupus Ficus Compositus, N.F.*, 20 p. c.

2. *Pulvis Glycyrrhizæ Compositus*, 18 p. c. 3. *Confectio Sennæ, N.F.*, 10 p. c., + cassia fistula 16, tamarind 10, prune 7, fig 12, water 65, digest, strain, add sucrose 55.5, evaporate to 89.5, add senna 10, oil of coriander .5. Dose, ʒj–2 (4–8 Gm.). 4. *Infusum Sennæ Compositum, Black Draught, N.F.*, senna 6 Gm., manna 12, magnesium sulphate 12, fennel 2, boiling water q. s. 100 cc.; must be recently prepared. Dose,

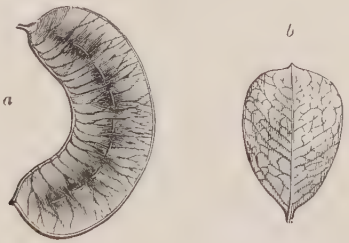


Fig. 188.—*Cassia obovata: a*, legume; *b*, leaflet, about natural size.

ʒj–3 (30–90 cc.). 5. *Species Laxativæ, St. Germain Tea, N.F.*, 40 p. c., + sambucus 25, fennel 12.5, anise 12.5, potassium bitartrate 10. Dose, gr. 15–30 (1–2 Gm.).

Unoff. Preps.: Extract, gr. 5–20 (.3–1.3 Gm.). Infusion (Br.), 10 p. c. + ginger .5. Compd. Syrup 13.5 p. c., +. Tinctura Sennæ Composita (Br.), 20 p. c.

Properties.—Cathartic, acts on nearly the entire intestinal tract (especially colon), increasing peristalsis and intestinal secretion, except biliary; produces in 4 to 6 hours copious yellow stools, with griping and flatulence; does not cause hypercatharsis nor constipation. Large dose vomits, purges, with severe tenesmus, but never poisons; the odor acts as a cathartic on very susceptible persons.

Uses.—Arabians used it in skin affections; now employed for habitual constipation, hemorrhoids, fissura ani, fevers. Its smell, taste, tendency to nauseate, injurious effects in hemorrhoids, intestinal hemorrhage, and inflammation, all lessen its popularity; its purgative action is increased by bitters, calumba, etc., while the griping and nausea are diminished by coriander, tamarind, manna, fennel, Epsom

or Rochelle salt. If leaves be macerated long in water, or if the mass be pressed tightly, much acrid, resinous principle will be obtained, causing griping, hence should exhaust by rapid percolation.

Allied Plants:

1. *Cassia obova'ta.*—Leaflets, U.S.P. 1830–1860. This was the first senna known, being introduced by the Moors into Europe as early as the 9th century, where even in the 16th it became very largely cultivated. Grows wild on sandy soil in Egypt, Nubia, Abyssinia,

FIG. 189.—*Cassia Fistula.*

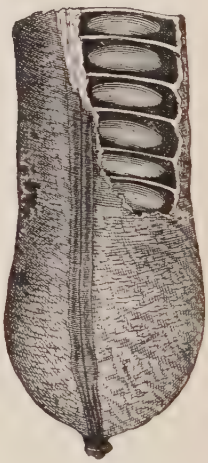


FIG. 190.—*Cassia Fistula:* Part of pod, natural size.

Tripoli, Senegal, Arabia, India; cultivated in Jamaica, being called *Port Royal* or *Jamaica Senna;* leaves 5–7 pairs, leaflets obovate, obtuse. *C. pubes'cens* (*C. holoseric'ea*), *Aden Senna*, Abyssinia, rarely met with now; leaflets 2.5 Cm. (1′) long, ovate, mucronate, hairy, sometimes mixed with Mecca senna. *C. brev'ipes*, C. America; leaflets resemble Indian senna, but have 3 longitudinal veins; infusion non-purgative.

2. *C. marylan'dica.*—Leaflets, U.S.P. 1820–1870; United States, New England to S. Carolina, west to the Mississippi. Plant 1–1.5

M. (3–5°) high; leaves alternate, leaflets paripinnate, 8 pairs, 2.5–5 Cm. (1–2′) long, 12 Mm. (½′) wide; flowers August, yellow; fruit pod, 7.5 Cm. (3′) long; in sandy soil, river banks, introduced into England in 1723, cultivated for ornament, collected Aug.–Sept.; contains cathartic acid, volatile oil, and is given in one-third larger doses than the official varieties; in infusion.

3. *C. Fis'tula, Purging Cassia, N. F.*—The dried fruit with not more than 2 p. c. of foreign organic matter; E. India, Egypt, nat. in S. America, W. Indies. Handsome tree, 9–15 M. (30–50°) high; bark gray; leaves paripinnate, leaflets 3–7 pairs, 5–15 Cm. (2–6′) long, ovate; flowers yellow. Fruit cylindrical, 25–50 Cm. (10–20′) long, 20 Mm. (⅘′) thick, chestnut-brown, on one side a longitudinal groove (ventral), on the other a slight ridge (dorsal), indicating the 2 sutures, indehiscent, 25–100 transverse compartments, each with a brown seed, 8 Mm. (⅓′) long, embedded in blackish-brown pulp (30 p. c.) having prune-like odor, mawkish sweet taste; contains (pulp) sugar 60 p. c., mucilage, pectin, albuminoids, tannin, volatile oil, butyric acid, calcium oxalate. Laxative; costiveness, to promote bile flow; usually combined with other drugs (manna, tamarind, salines, etc.). Dose, ʒj–2 (4–8 Gm.); 1. *Confectio Sennæ*, 16 p. c.

33. KRAMERIACEÆ. Krameria Family.

Kra-me-ri-a'se-e. L. *Krameri-a* + aceæ, in honor of Drs. J. G. H. and W. H. Kramer, German botanists, of the eighteenth century. Pubescent herbs, shrubs. Distinguished by leaves simple, exstipulate; flowers purplish, racemes, sepals large, 4–5, petals 4–5, smaller than sepals, stamens 3–4, monadelphous; ovary 1-celled, ovules 2; fruit spiny, indehiscent, 1-seeded; temperate climates, tropics; astringent, tonic, dye, ornament.

Genus: **1. Krameria.**

KRAMERIA. KRAMERIA, *U.S.P.*

Krameria { **triandra,** *Ruiz et Pavon,* / **argentea,** *Martius.* } The dried root.

Habitat. 1. Peru, Bolivia. 2. Brazil (in sandy localities of the mountains, elevation 925–2465 M. (3,000–8,000°)).

Syn. Rhatany; Br. Krameriæ Radix; Fr. Ratanhia; Ger. Radix Ratanhiæ, Ratanhiawurzel.

Kra-me'ri-a. L. see etymology, above, of Krameriaceæ.

Tri-an'dra. L. fr. Gr. τρι, three, + ἀνδρός man, stamen—*i. e.*, flowers have 3 stamens.

Ar-gen'te-a. L. fr. *argenteus*, silvery, silvered—*i. e.*, leaves, whitish from adpressed silvery hairs.

Rhat'a-ny. Fr. Peruv. *ratana*, native name; Sp. *ratania, ratana*, creeping—*i. e.*, the plant's habit.

Plants.—Low shrubs with spreading, decumbent branches; bark grayish-brown, when young hoary with erect silky hairs; leaves sessile,

densely covered on both sides with adpressed silvery hairs, 12 Mm. ($\frac{1}{2}'$) long, obovate, entire; flowers Oct.–Nov., 18 Mm. ($\frac{3}{4}'$) broad, red; sepals 4, scarlet, in form of a cross; petals 4, dissimilar, red; fruit, size of a pea, 6 Mm. ($\frac{1}{4}'$) thick, covered with stiff reddish-brown prickles, 1–2-seeded. Root (*K. triandra*): *Peruvian*, crown knotty, several-headed, branching roots, latter up to 50 Cm. (20′) in length, 1 Cm. ($\frac{2}{5}'$) thick, cylindrical, flexuous, reddish-brown, with darker scaly cork, wrinkled, devoid of transverse fissures; bark one-third of radius, fracture slightly fibrous, of wood tough, splintery; wood yellowish, finely radiate; inodorous; bark astringent, wood nearly tasteless; (*K. argentea*): *Para*, usually separate from the crown, less flexuous, tapering, tough, internally darker, usually not exceeding 12 Mm. ($\frac{1}{2}'$) in thickness;

Fig. 191.—*Krameria triandra.*

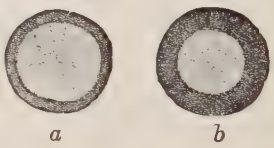


Fig. 192.—Krameria: transverse sections: root; *a*, Peruvian; *b*, Savanilla.

purplish-brown with numerous fissures, bark one-half the radius. Powder, reddish-brown—starch grains, central cleft, .003–.035 Mm. ($\frac{1}{83}$–$\frac{1}{33}$–$\frac{1}{71}$–$\frac{1}{15}'$) thick, bast-fibers wavy with attenuated ends, tracheæ, wood-fibers fusiform, calcium oxalate prisms, few microcrystals. *Solvents:* cold water; boiling water; alcohol. Dose, gr. 5–30 (.3–2 Gm.).

Commercial.—We have two important varieties: 1. *Peruvian, Payta, Red Rhatany* (*K. triandra*).—Abundant around Huanuco and Lima, mainly shipped from Payta. 2. *Para, Brazilian, Ceara, Brown Rhatany* (*K. argentea*). Although darker and less purple, it resembles *K. Ixina*, for which during the past few years it has largely been sold; shipped chiefly from Para. Constituents are mostly in the bark, hence the thick-barked root, with little wood, is preferred. Roots are dug after rains mostly in S. Peru, especially in Arica and Islay provinces.

Constituents.—Kramero-tannic acid 20 p. c., Rhatanic-red, rhatanine, starch, sugar, gum, wax, calcium oxalate, ash 5 p. c., aqueous extractive 9 p. c.

Kramero-tannic Acid (*krameria-* or *ratanhia-tannic acid*).— Obtained by treating ethereal extract of bark with alcohol and evaporating this latter solution. It is a red, amorphous powder, precipitated dark green by ferric salts and flesh-colored by galatin; no precipitate from tartar emetic, but fused with potassium hydroxide yields protocatechuic acid and phloroglucin; alcoholic tincture of Peruvian is reddish, Para and Savanilla yellowish, lead acetate with former gives reddish-brown, with two latter bluish-gray precipitate.

Rhatanic-red (*ratanhia-red*). $C_{26}H_{22}O_{11}$.—Obtained by boiling kramero-tannic acid with diluted sulphuric acid, when it splits into glucose and this coloring principle, which is similar to that found in horse-chestnut and tormentilla.

Preparations.—1. *Tinctura Krameriæ.* Tincture of Krameria. (Syn., Tr. Kramer.; Fr. Teinture de Ratanhia; Ger. Tinctura Ratanhiæ, Ratanhiatinktur.)

Manufacture: 20 p. c. Macerate, percolate similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol. Dose, ♏xv–60 (1–4 cc.).

2. *Extractum Krameriæ, N.F.* (water). Dose, gr. 5–10 (.3–.6 Gm.).

3. *Fluidextractum Krameriæ, N.F.* (1st menstruum: glycerin 10, alcohol 50, water 40, 2d: diluted alcohol). Dose, ♏v–30 (.3–2 cc.).

Prep.: 1. *Syrupus Krameriæ, N.F.*, 45 p. c. Dose, ʒss–4 (2–15 cc.).

4. *Fluidglyceratum Krameriæ, N.F.*, 100 p. c. Dose, ♏v–30 (.3–2 cc.).

Unoff. Preps.: Infusion (Br.), 5 p. c., ʒj–2 (30–60 cc.). *Lozenge* (Br.), ext. 1 gr. (.06 Gm.). *Lozenge Krameria and Cocaine* (Br.), ext. 1 gr. (.06 Gm.) + cocaine hydrochloride $\frac{1}{20}$ gr. (.003 Gm.).

Properties.—Similar to tannic acid, astringent, tonic.

Uses.—Chronic diarrhea, stomach and intestinal hemorrhage, leucorrhea, dysentery, gleet, gonorrhea, ozena, menorrhagia, fissure of anus or nipple, incontinence of urine. Externally—gargle for sore throat, mucous membranes of eyes, nose, gums, epistaxis, rectal bleeding, relaxed uvula, tooth powder and wash. Generally used locally by injection, gargle, wash, enema (extract 2 p. c. in water).

Allied Plants:

1. *Krameria Ixi'na. Savanilla, New Granada, Antilles, Violet Rhatany.*—This abounds in Colombia, Venezuela, Guiana, Brazil, Haiti, Antigua, Mexico. Similar to Para Rhatany. Of this species we have several varieties collected indiscriminately and so used: 1. Var. *granaten'sis*, which is distinguished solely by its broader leaves. 2. Var. *tomento'sa;* this is an extremely woolly form, and by some deemed deserving of specific rank (*K. tomentosa*), being shipped not only from Savanilla, but also from Carthagena, Santa Marta, etc.—for some years out of market, but now returning; constituents and uses same as the official.

KRAMERIACEÆ

2. *K. cistroi'des.* Chile.—Roots resemble Peruvian very closely, wood of tap-root pale reddish in outer layer, brownish-red in the center. *Guayaquil Rhatany* (origin unknown), root large, contorted, bark thin, fibrous, rich in tannin, reddish-brown, striated, warty. *K. secundiflo'ra* (*lanceola'ta*), *Texas Rhatany;* roots valuable, thin, dark brown, bark thick, rich in tannin; *Florida Rhatany*—same source, and similar to Texas; neither on the market.

3. *Hæmatox'ylon campechia'num, Hematoxylon, Logwood, N.F.*—The heartwood with not more than 2 p. c. of foreign organic matter. C. America, nat. in W. Indies. Spreading tree, 7.5–12 M. (25–40°) high, .3–.6 M. (1–2°) thick, knotty, tough; bark dark, rough, white dotted; leaves paripinnate, leaflets 4–5 pairs, obcordate, smooth; flowers yellow, racemes, jonquil odor; fruit legume, 2.5–4 Cm. (1–1⅗′) long, compressed, tapering ends, 2-seeded. Heartwood in logs 1 M.

FIG. 193.—*Hæmatoxylon campechianum:* 1, flower; 2, fruit.

FIG. 194.—Lignum campechianum; cross-section, magnified 4 diam.

(3°) long, 15 Cm. (6′) thick, sp. gr. 1.06, hard purplish-black, internally brownish-red, irregular concentric circles, medullary rays 4 cells wide; odor faint, agreeable; taste sweetish, astringent; colors saliva dark pink. In shops as small chips, occasionally in billets, coarse powder, reddish-brown, freshly cut surface dark yellowish-red. Powder, reddish-brown—wood-fibers, crystal-fibers with calcium oxalate monoclinic prisms, tracheæ with brownish amorphous content; medullary rays, walls of cells with simple pores; pieces with a greenish luster (fermentation or oxidation of hematoxylin into hematein by ammonia in the air) should be rejected. It imparts a yellowish color to slightly acidified water, changed to purple or violet-red by alkalies (red with Brazil wood, no change with red saunders); solvents: boiling water, alcohol; contains hematoxylin 12 p. c., volatile oil, tannin, fat, resin, ash 3.5 p. c. There are four varieties: 1, Campeachy; 2, Honduras; 3,

St. Domingo; 4, Jamaica. Astringent, tonic, antiseptic, similar to tannin; cholera infantum, chronic diarrhea, dysentery, leucorrhea, hemorrhage, dyspepsia; antiseptic in gangrene, ulcers, cancer; chiefly in dyeing violet, blue, gray, black. Dose, ℥ss–1 (2–4 Gm.); 1. *Extractum Hæmatoxyli*, 10 p. c. (water), dose, gr. 5–15 (.3–1 Gm.); decoction (Br.) 5 p. c. + cinnamon 1, ℥ss–2 (15–60 cc.).

34. PAPILIONACEÆ. Pea Family.

Pa-pil-i-o-na'se-e. L. *Papilio-n* + aceæ, butterfly—*i. e.*, alluding to the corolla being butterfly-shaped. Herbs, shrubs, vines, trees. Distinguished by leaves compound, stipulate; flowers papilionaceous, calyx 4–5-toothed, petals perigynous or hypogynous, upper one enclosing the lateral ones in the bud, stamens usually 10; pistil 1, ovary 1- celled; fruit legume or loment, 1-many-seeded; universal; astringent, antispasmodic, demulcent, sedative, dye, poisonous, timber.

Genera: **1. Toluifera. 2. Astragalus. 3. Pterocarpus. 4. Glycyrrhiza. 5. Vouacapoua (Andira). 6. Physostigma.**

TOLU. TOLU, *U.S.P.*

Toluifera Balsamum, *Linné.* } A balsam.

Habitat. S. America (Venezuela, Colombia, Peru); high rolling countries.

Syn. Balsamum Tolutanum, Balsam of Tolu, U.S.P. 1910, Tolu Balsam; Fr. Baume—du Tolu—de Carthagène; Ger. Tolubalsam.

To-lu-if'e-ra. L. *tolu* + *fero, ferre,* to bear, producing tolu or an allied balsam —*i. e.*, it was brought first from Tolu, now Santiago de Tolu in U. S. Columbia.

Bal'sa-mum. L. fr. Gr. *βάλσαμον,* for balsam, name of balsam tree—*i. e.*, from its characteristic secretion.

Plant.—Evergreen tree 24 M. (80°) high, often branchless for 15 M. (50°) above ground, roundish spreading head; bark smooth, yellowish-brown, with numerous white lenticels; leaves having 4–7 leaflets; flowers upon smooth pedicels, dense racemes, 10–12.5 Cm. (4–5′) long; calyx broadly tubular upon hispid pedicel, mouth 3–4-lobed; anthers versatile; fruit 10–12.5 Cm. (4–5′) long. Balsam (Tolu) is a yellowish-brown plastic solid, brittle when old, dried, or exposed to cold, transparent in thin layers; odor pleasant, aromatic, vanilla-like; taste mild, aromatic; soluble in alcohol, chloroform, ether, solutions of fixed alkalies, usually leaving insoluble residue; nearly insoluble in water, petroleum benzin; alcoholic solution (1 in 20)—acid. *Tests:* 1. Shake 1 Gm. with carbon disulphide (25), let stand 30 minutes, filter, evaporate 15 cc. to dryness, dissolve residue in glacial acetic acid, + few drops of sulphuric acid—not green; shake remainder of filtrate with equal volume of aqueous solution of copper acetate (1 in 1000)—not green (abs. of rosin, copaiba). Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Turpentine—blackish instead of cherry-red with sulphuric acid, soluble in carbon disulphide; sweet gum—yields styracin

to hot benzin, crystallizing when cold; storax, rosin, copaiba, saponifiable substances, various other resins. A factitious balsam has been found containing storax 63 p. c.

Commercial.—Plant resembles *Toluifera Pereiræ* in flowers and fruit but differs from it in having shorter leaves, smaller and fewer leaflets, recurved with non-puckered margin, non-hairy rachis and petiole, and less prominent glands. Balsam—a physiological product in very young tissues, thereafter becoming pathological, possibly an antiseptic protec-

Fig. 195.—*Toluifera Balsamum:* twig one-third natural size, with fruit.

tive against depleting local injury—is collected by making V-shaped incisions through the bark and hollowing out the wood below each to support a small calabash cup for catching the flow, there often occurring 20–30 of these from the ground upward (2.5–3 M.; 8–10°), the higher being cut from ladders or scaffolds. Bleeding continues, July–April, at the rate of filling the cups "each moon," they being emptied as occasion demands into rawhide flask-shaped bags (carried by donkeys) which when filled are sent to ports along the Magdalena and Orinoco Rivers where the balsam is transferred to cylindrical tins (10–25

pounds; 4.5–11.5 Kg.), formerly calabashes or baked earthen jars, and as such enters commerce via Carthagena.

CONSTITUENTS.—Resin 75–80 p. c., Cinnamic and Benzoic acids 18–20 p. c., Volatile oil 1 p. c., Vanillin .05 p. c., benzyl cinnamate and benzyl benzoate—last two form an acid, aromatic oily liquid 7.5 p. c.

Resin, $C_{18}H_{20}O_5$.—Chief constituent, consisting of tolu-resinotannol combined with cinnamic acid and small amount (1.5 p. c.) of benzoic acid; it is amorphous, black, brittle, similar to that of *T. Pereiræ*, having a portion soluble in carbon disulphide, which upon evaporation yields a crystalline, nearly colorless residue about 25 p. c. of the balsam; a portion of resin sparingly, another readily soluble in alcohol.

Volatile Oil.—Obtained by distilling with water; contains benzyl benzoate, benzyl cinnamate, phellandrene, farnesol, hardens by exposure, odor pleasant, sp. gr. 0.858.

Acids.—Obtained by distillation—benzoic, cinnamic, with benzylic ethers of both, the benzyl cinnamate predominating. Trommsdorf found resin 88 p. c., volatile oil .2 p. c., cinnamic acid 12 p. c., this latter coming over as a heavy oil condensing into white crystalline mass. Dry distillation gives the above acids and ethers, also styrol, phenol, toluol—this latter being found in coal tar, wood tar, organic compounds, balsams (Peru, etc.) and resins; it is a colorless, oily liquid, readily convertible into benzoic acid.

PREPARATIONS.—1. *Tinctura Tolu.* Tincture of Tolu. (Syn., Tr. Tolu, Tinctura Tolutana, Tolu Tincture; Fr. Teinture de Baume de Tolu; Ger. Tolubalsamtinktur.)

Manufacture: 20 p. c. Similar to Tinctura Cardamomi Composita, page 137; menstruum: alcohol. Dose, ♏x–30 (.6–2 cc.).

Prep.: 1. *Syrupus Tolu.* Syrup of Tolu. (Syn., Syr. Tolu, Syrupus Tolutanus; Fr. Sirop (balsamique)—de Baume de Tolu; Ger. Tolubalsamsirup.)

Manufacture: 1 p. c. Rub tincture of Tolu 5 cc. + magnesium carbonate 1 Gm. + sucrose 6, gradually add with trituration, water 43 cc., filter; dissolve in clear filtrate, gently heating, sucrose 76 Gm., strain syrup (hot), add through strainer, water q. s. 100 cc. Dose, ʒj–4 (4–15 cc.).

Preps.: 1. *Trochisci Ammonii Chloridi,* q. s. 2. *Emulsum Olei Morrhuæ cum Vitello, N.F.,* 10 p. c. 3. *Mistura Pectoralis, N.F.,* q. s.

1. *Pilulæ Phosphori,* q. s. 2. *Tinctura Benzoini Composita,* 4 p. c. 3. *Pilulæ Ferri Iodidi, N.F.,* q. s.

Unoff. Preps.: Emulsion. Inhalations (steam—acute laryngitis with aphonia). *Lozenges.*

PROPERTIES.—Stimulant, expectorant, disinfectant, vulnerary, stomachic.

USES.—Much less decided than balsam of Peru, but similar; bronchitis, diphtheritic deposits, catarrh, coughs, flavoring, perfumery.

Incompatibles: Water and aqueous preparations with the tincture.

PAPILIONACEÆ

Synergists: Balsams, aromatic drugs, volatile oils, stimulant expectorants.

Allied Plants:

1. *Myrox'ylon puncta'tum.*—The *Quino-quino* tree, and *M. peruif'erum*, both of Peru; yield balsams resembling official Peru and Tolu.

BALSAMUM PERUVIANUM. BALSAM OF PERU, *U.S.P.*

Toluifera Pereiræ, (*Royle*) *Baillon.* } A balsam.

Habitat. Central America (San Salvador), in woods near the coast.

Syn. Bals. Peruv., Peru Balsam, Balsamum Peruvianum Nigrum, Balsamum Indicum, Black Balsam; Fr. Baume—du Pérou,—de Sonsonate,—des Indes; Ger. Perubalsam, Indischer Balsam.

Per-ei'ræ. L. of Pereira—*i. e.*, in memory of Jonathan Pereira (1804–1853), the author of *Elements of Materia Medica*, and Professor to the British Pharmaceutical Society, who visited S. America to study these and many other plants.

Pe-ru-vi-a'num. L. adj. form, fr. *peruvianus* of or pertaining to Peru—*i. e.*, the secretion.

Plant.—Handsome tree, 15–25 M. (50–80°) high, branching 2.5 M. (8°) above ground; leaves 6–10, alternate, 15–20 Cm. (6–8′) long, imparipinnate; leaflets 5–7.5 Cm. (2–3′) long, oblong-ovate, hairy, puckered margin; flowers 12 Mm. ($\frac{1}{2}$′) long, whitish, tomentose, racemes; fruit 1-seeded legume 10 Cm. (4′) long, yellowish-brown. Balsam (of Peru), is a viscid, dark brown liquid, free from stringiness or stickiness, transparent and reddish-brown in thin layers; odor agreeable, vanilla-like; taste bitter, acrid, persistent, burning sensation in the throat when swallowed; does not harden on exposure; soluble in alcohol, chloroform, glacial acetic acid with slight opalescence, partly soluble in ether, petroleum benzin; agitated with water—latter acid to litmus; sp. gr. 1.145. *Tests:* 1. Shake 1 Gm. with chloral hydrate (3) in distilled water (2)—clear solution (abs. of fixed oils). 2. Shake 1 Gm. with purified petroleum benzin (5), warm 10 minutes, replacing loss by evaporation, evaporate 2 cc.—no turpentine odor, and residue treated with few drops of nitric acid—not green or bluish (abs. of turpentine, rosin). Dose, ℥v–30 (.3–2 cc.).

Adulterations.—Extract of bark and wood, alcohol, fixed and volatile oils, castor oil, storax, benzoin, gurjun balsam, copaiba, Canada turpentine, rosin, water.

Commercial.—Plants grow wild in forests, either isolated or in groups, occasionally in apparent rows suggesting original planting, but there is no evidence of regular plantations, do not thrive above 300 M. (1,000°) elevation, bear fragrant flowers, yield mahogany-like wood and balsam after the 25th year continuing for 75 years. Balsam, a pathological product that owes its qualities to neither wood nor bark but to the special treatment of the trees, is collected by the aborigines in a district reserved to them, Sonsonate, Balsam Coast, extending

from Acajutla to La Libertad, San Salvador. After the last rains, Nov.-April, the outer cortical portion is scraped from the trunk and stout branches in alternating strips (or squares, 12′; 30 Cm.) an $\frac{1}{8}$ inch (3 Mm.) deep, exposing the inner layer from which, within 5–8 days, the mature sap begins to flow; after this has continued a week the tender portion is covered with a clean cloth to absorb the sap, and a second irritation effected by carefully applying a burning torch for 5 minutes, and repeating this every 2 months, six changes of cloths

FIG. 196.—*Toluifera Pereiræ.*

during each interval; a second hacking often follows; cloths are boiled half an hour in kettles with water, expressed (hot) in primitive press, and squeezed—the balsam being caught in large bladders, gourds, or wooden bowls—that in the kettles settles to the bottom and, after pouring off supernatant liquid is mixed with that from the cloths furnishing "crude or raw balsam," which is refined by heating moderately in a vat, whereby water is evaporated and impurities rise to the surface, straining, when the "clarified balsam" is poured into rectangu-

lar, screw-top tin canisters, 55 pounds (25 Kg.). As long as the wounds are kept open there usually is some flow, and if the process is conducted carefully the lower ones will heal while the upper and fresher are being worked; the loose bark and wood are ground up and extracted, the extract being added to the other collected portions. When trees have been tapped six consecutive seasons a rest of 2–3 years renders the product more abundant and satisfactory, while a longer period, 5–6 years in every 20, assures a continued yield; each tree averages 2–5 pounds (1–2.5 Kg.) annually. It is exported from Acajutla (Pacific coast) and Belize (Atlantic coast) in jars, metallic canisters, drums, etc. There also is obtained from the fruit by expression a white semi-fluid substance, *Balsamo blanco*, having the odor of Tonka and the appearance of Tolu, but, in spite of containing a crystalline resin, *myroxocarpin*, it is entirely distinct from Tolu or Peru. The natives prepare from the fruit with rum a tincture or alcoholic extract, *Balsamito*, which is used as a stimulant, anthelmintic, diuretic, and externally for indolent ulcers, freckles, etc., while there often exudes from the trees a gum-resin containing 77.4 p. c. of resin, but no aromatic principle or cinnamic acid. Balsam of Peru was considered formerly to be from *Myroxylon peruiferum*, a different tree flourishing in Brazil, Ecuador, Peru, whose product reached Europe via Peru (Callao), hence its name, being a fragrant balsam resembling Tolu and at Rio called *Olea vermelho*.

Constituents.—Benzoic acid-benzyl ester, Cinnamein (volatile oil) 56–66 p. c., Resin 16–25 p. c., Cinnamic and Benzoic acids 23 p. c., Vanillin.

Benzoic Acid-benzyl Ester (Benzyl Benzoate).—The chief active constituent is a colorless oily liquid, boiling at 173° C. (344° F.), congealing at 32° C. (90° F.), and may readily be made synthetically.

Cinnamein.—Consists largely of benzoic acid-benzyl ester, and to a small extent of cinnamic acid-benzyl ester (benzyl cinnamate) both esters being separated easily by fractional distillation *in vacuo*, and thus obtained pure possess the characteristics, chemical and therapeutical, of the synthetic esters; the cinnamic acid-benzyl ester boils at 213° C. (416° F.), and congeals at 37° C. (99° F.).

Resin.—Consists of peru-resinotannol combined with benzoic and cinnamic acids, soluble in caustic alkali, and when in solution precipitated by carbon dioxide, insoluble in carbon disulphide; on dry distillation yields benzoic acid, styrol, and toluol, C_7H_8.

Preparations.—1. *Mistura Oleo-Balsamica, Hoffman's Balsam, N.F.*, 1.6 p. c., + eugenol, oils of cinnamon, lavender, lemon, myristica, thyme, āā $\frac{2}{5}$ p. c., alcohol q. s. 100 (nervine). 2. *Solutio Mastiches Chloroformica Composita, N.F.*, 30 p. c. *Ointment. Syrup.*

Properties.—Stimulant, expectorant, disinfectant, vulnerary, stomachic. It is eliminated by bronchial mucous membrane, kidneys, and skin, stimulating and disinfecting their secretions.

Uses.—Chronic catarrh, asthma, phthisis, gonorrhea, amenorrhea, rheumatism, palsy; externally on indolent ulcers, scabies, ringworm, tonsillar diphtheria, bronchitis, tuberculosis of the skin, bone, or larynx, chilblains, eczema, for masking the odor of iodoform in ointment.

Allied Plants:

1. *Cyt'isus Scopa'rius, Scoparius, Broom Tops, N.F.*—The dried tops with not more than 5 p. c. of stems over 3 Mm. ($\frac{1}{8}'$) thick nor 2 p. c. of other foreign organic matter; W. Asia, S. Europe, United States. Shrub 1.2–2.4 M. (4–8°) high, with many pentangular, wand-like branches in close fascicles—suitable for broom-making; leaves downy, trifoliate; leaflets sessile, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}'$) long, lanceolate; flowers numerous, large, brilliant yellow, papilionaceous; fruit pod, 4 Cm. ($1\frac{3}{5}'$) broad, compressed. Tops—stems thin with branched twigs, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}'$) thick, angled, winged, dark green, nearly glabrous, many brownish cork patches; internally yellowish; fracture short-fibrous (thin), tough and splintery (thick); leaves scarce; odor slight, on bruising more distinct; taste disagreeable, bitter. Powder, dark green—non-glandular, non-lignified hairs, chlorenchyma, stomata, pith and wood parenchyma, tracheæ, starch grains, pollen grains; solvent: diluted alcohol; contains sparteine (colorless oily liquid alkaloid) .3 p. c., scoparin (diuretic), volatile oil, tannin, fat, wax, sugar, ash 5 p. c. Cardiac stimulant, narcotic, diuretic, poisonous; large doses paralyze respiratory and motor centers, causing convulsions and death by asphyxia; cardiac affections, palpitation—inferior to digitalis, although quicker and without cumulative tendency. *Poisoning:* similar to digitalis in effect and treatment. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Scoparii* (diluted alcohol). *Decoction, Infusion*, each 5 p. c., ℥j–2 (30–60 cc.); juice, 75 p. c., + alcohol 25, ℥j–2 (4–8 cc.); sparteine sulphate, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.); scoparin, gr. 1–10 (.06–.6 Gm.). *Spar'tium jun'ceum, Spanish Broom*—leaves soft, hairy; seed reniform; properties similar to *Cytisus Scoparius;* fibers used for cordage, coarse cloth, etc.

Fig. 197.—*Cytisus Scoparius:* flowering branch.

2. *Baptis'ia tincto'ria, Baptisia, Wild (False) Indigo, N.F.*—The dried root with not more than 10 p. c. of stem-bases and overground parts nor 2 p. c. of other foreign organic matter; N. America. Plant

PAPILIONACEÆ

.6–1 M. (2–3°) high, smooth, succulent, glaucous, disagreeable odor, when bruised—repellent to insects, etc.; flowers yellow. Root (most active), fleshy, .5–4 Cm. ($\frac{1}{5}$–$1\frac{3}{5}'$) thick, usually cut into elongated cylindrical pieces; crown 5–8 Cm. (2–$3\frac{1}{5}'$) thick, warty, stem-scars, dark brown, wrinkled, corky layer, few branching rootlets; fracture tough, whitish, radiate, porous; nearly odorless, bark bitter, acrid, wood nearly tasteless. Powder, light grayish—numerous starch grains, tracheæ, lignified fibers, medullary ray tissue, parenchyma, cork cells; solvent: 75 p. c. alcohol; contains cytisine (baptitoxine—acrid, poisonous), baptisin (non-active bitter glucoside), baptin (purgative glucoside), ash 5 p. c. Hepatic, nervous and intestinal stimulant, antipyretic, emeto-cathartic— death by respiratory paralysis; typhus, enteric and scarlet fevers, epidemic dysentery; locally—aphthous stomatitis, chronic ulcers, gangrene. Dose, gr. 5–15 (.3–1 Gm.); 1. *Fluidextractum Baptisiæ* (75 p. c. alcohol): Prep.: 1. *Dentifricium*, .875 p. c. Infusion, Tincture, Baptisin, gr. 2–6 (.13–.4 Gm.).

3. *Melilo'tus officina'lis, Melilotus, (Yellow) Melilot, Yellow Sweet Clover, N.F.*—The dried leaf and flowering top with not more than 3 p. c. of stems over 3 Mm. ($\frac{1}{8}'$) thick or other foreign organic matter; Europe, United States. Plant 1–1.5 M. (3–5°) high; stems mostly less than 30 Cm. (12′) high, slender, leafy below, terminating in yellow racemes, pubescent; leaves trifoliate, leaflets 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}'$) long, oval, serrate; corolla papilionaceous; legumes 2.5–3.5 Mm. ($\frac{1}{10}$–$\frac{1}{7}'$) long, obovate, 1-seeded; odor aromatic, tonka-like; taste sweetish, slightly pungent, bitter. Powder, light green—non-glandular hairs, epidermal cells of leaf tissue, stomata, chlorenchyma, fibro-vascular tissue, crystal-fibers with calcium oxalate prisms, tracheæ, pollen grains, occasional glandular hairs; solvent: diluted alcohol; contains coumarin, melilotic acid, coumaric acid, melilotol (fragrant volatile oil), ash 10 p. c. Locally—to allay pain in abdomen, joints, diarrhea, dysmenorrhea, rheumatism; 1. *Species Emollientes*, 20 p. c. Decoction, Infusion, Ointment, Plasters.

4. *Trifo'lium praten'se, Trifolium, Red Clover Blossoms, N.F.*—The dried inflorescence with not more than 2 p. c. of foreign organic matter; Europe, naturalized in N. America. Well-known fodder-plant. Heads ovoid, 12–25 Mm. ($\frac{1}{2}'$) long and broad, shriveled, purplish, brownish on drying, consisting of many small papilionaceous flowers crowded together, stipules green; leaves trifoliate; odor faintly aromatic, tea-like, taste sweetish, slightly bitter. Powder, greenish-brown —non-glandular hairs, pollen grains, epidermis with stomata, polygonal cells (corolla) with rhombohedron of calcium oxalate; solvent: diluted alcohol; contains isorhamnetin, pratol, tannin, pratensol, trifolin (glucoside). Alterative, deobstruent, sedative; whooping-cough, spasmodic affections. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Trifolii* (diluted alcohol); 2. *Fluidextractum Trifolii Compositum*, 21.5 p. c., + glycyrrhiza 21.5, berberis, cascara amara, lappa, phytolacca, stillingia, āā 10.8, xanthoxylum 3, (33 p. c. alcohol), dose, ʒj–2

(4–8 cc.): Prep.: 1. *Syrupus Trifolii Compositus*, 30 p. c., +, dose, ʒj–2 (4–8 cc.).

5. *Gale'ga officina'lis, Galega, European Goat's Rue, N.F.*—The dried flowering herb with no stems over 4 Mm. ($\frac{1}{6}'$) thick or more than 3 p. c. of foreign organic matter; S. Europe. Small perennial; stem smooth, 15–45 Cm. (6–18′) long, usually cut and broken; leaves imparipinnate, leaflets bright green, lanceolate, 2–5 Cm. ($\frac{4}{5}$–2′) long, 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}'$) broad; flowers white, violet, racemes; odor indistinct; taste mucilaginous, slightly bitter, astringent—colors saliva yellowish-green. Powder, yellowish-green—stomata, non-glandular hairs, tracheæ, crystal-fibers with calcium oxalate monoclinic prisms, isodiametric parenchyma, pollen grains, few or no starch grains; solvent: diluted alcohol; contains bitter principle, tannin, ash 12 p. c. Galactagogue, diuretic, diaphoretic, vermifuge. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Galegæ* (diluted alcohol).

6. *Trigonel'la Fœn'um-græ'cum, Fenugreek.*—The seed; India, Europe; cultivated in France, Germany, etc. Annual herb, .3 M. (1°) high, leaves trifoliate, leaflets dentate, flowers yellowish, fruit compressed legume containing 16 seed; seed 3 Mm. ($\frac{1}{8}'$) long and broad, 2 Mm. ($\frac{1}{12}'$) thick, rhombic, flattened, brownish-yellow, large diagonal groove; strong aromatic, to some pleasant, odor; taste mucilaginous, bitter; contains volatile oil, fixed oil 6 p. c., mucilage 28 p. c., proteins 22 p. c., bitter principle, choline, trigonelline .13 p. c. Powder sometimes adulterated with ground amylaceous seeds. Used similar to flaxseed, elm, althea; emollient cataplasms, enemata, ointments, plasters, decoction, 5 p. c. (usually thick and slimy); demulcent in veterinary condition-powders.

TRAGACANTHA. TRAGACANTH, *U.S.P.*

Astragalus gummifer, *Labillardière,* or other Asiatic species. } The dried gummy exudation.

Habitat. W. Asia—Asia Minor, Armenia, Kurdistan, Persia, Syria, Greece; mountainous districts.

Syn. Trag., Gum Tragacanth, Goat's Thorn Gum, Doctor's Gum, Hog Gum; Fr. Gomme Adragante; Ger. Traganth.

As-trag'a-lus. L. fr. Gr. *ὀστέον*, bone, + *γάλα*, milk—*i. e.*, the milky then horny exudation, or from the seed squeezed into a square-like form similar to vertebræ (*αστράγαλος*) in some species.

Gum'mif-er. L. *gummi*, gum, + *ferre*, to bear—*i. e.*, plant produces gum.

Trag-a-can'tha. L. fr. Gr. *τράγος* a goat, + *ἄκανθα*, thorn—a goat thorn—*i. e.*, plant thorny like goat's head, and hedges made of it resist their onslaughts.

Trag'a-canth, natively called first: "gum adragant," then "gum dragant," next "gum dragan," finally "gum dragon."

Plant.—Shrub .6–1 M. (2–3°) high; stem naked with many straggling, much ramified branches; bark reddish-gray, rough, and marked with leaf-scars, young twigs woolly; leaves 3 Cm. ($1\frac{1}{5}'$) long, closely placed, pinnate, rachis hard, stiff, persistent for some years as a woody

PAPILIONACEÆ

spine, yellow, very sharp-pointed; leaflets 10–15 pairs, 3 Mm. ($\frac{1}{8}'$) long, obovate, grayish-green; flowers small, pale yellow; stamens 10, upper one free, others united in a sheath; fruit small, oblong pod, covered with white hairs; seed 1, reniform, smooth, pale brown. GUM (tragacanth), in flattened, lamellated, frequently curved fragments, straight or spirally twisted pieces, .5–2.5 Mm. ($\frac{1}{50}$–$\frac{1}{10}'$) thick, whitish, brownish, translucent, horny; fracture short, rendered more easily pulverizable by heat (50° C.; 122° F.); inodorous; taste insipid, mucil-

FIG. 198.—*Astragalus gummifer* (natural size of branch).

aginous. POWDER, whitish, forming with water a translucent mucilage—numerous starch grains, .003–.025 Mm. ($\frac{1}{8325}$–$\frac{1}{1000}'$) broad, occasional 2–4 compound, many swollen and more or less altered, due to excessive heat used in drying before powdering, by which it loses 15 p. c. *Tests:* 1. Add 1 Gm. to 50 cc. of distilled water—swells and forms a smooth, nearly uniform, stiff, opalescent mucilage free from cellular fragments (Indian gum—uneven mucilage with few reddish-brown fragments, separating on stirring in coarse, uneven strings).

2. Shake 2 Gm. with 100 cc. of water, when fully swollen and free from lumps add 2 Gm. of powdered sodium borate, shake until dissolved—mucilage does not lose transparency, change consistency, or appear slimy or stringy on pouring, even after standing 24 hours (abs. of foreign gums). 3. Boil 1 Gm. with water 20 cc. until a mucilage results, add hydrochloric acid 5 cc. boil for 5 minutes —no pink or red color develops (abs. of Indian gum). *Solvents:* hot water; cold water best. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—*Cherry Gum* (cherry, almond, plum, etc.)—in irregular brownish nodules, insoluble portion not identical with bassorin; *Indian* (*Bassora, Kutera, Hogg*) *Gum*, Persia—broken up in Smyrna and mixed with tragacanth; occurs in yellowish-brown (sometimes whitened with lead carbonate), angular, tasteless masses, swelling with water; *Cashew Gum*—brownish-yellow, translucent, iridescent, partly soluble in water.

Commercial.—Tragacanth is not a simple plant juice, but a degenerative product due to the transformation of the cell-walls of pith and medullary rays in the stem and older branches, and exudes spontaneously, July–August, through natural, or artificial punctures, longitudinal and transverse incisions (near the base of stem) into the medullary part which alone yields juice; it only flows at night, the shape of opening and rate determining its final congealed outline, the time of hardening for collection (1–2 weeks, dry weather 3–4 days) governing its color—white if congealed rapidly, yellow to brown if slowly, from long exposure to changeable weather—heavy rains darkening and washing it off upon the ground causing admixture of impurities; the surface lines indicate the daily concretion while the whiter and more translucent possess greatest value. There are several varieties: 1. *Flake* (*Leaf, Smyrna*), usually in broad, thick, yellowish flakes, prominently ridged; the ribbon-like and white flakes are produced in Kurdistan, Persia, often being designated as Syrian; 2, *Vermiform* (*Vermicelli*), in very narrow contorted string-like pieces, or confluent coils; 3, *Common* (*Sorts*), called in Europe *traganton*, being the result of spontaneous exudation and incidental collection while gathering higher grades; occurs in tear-like pieces, rounded or irregular, brownish, waxy, and, like the preceding varieties, encloses starch. Enters commerce from ports of Asia Minor (Smyrna, Constantinople), Persian Gulf, Bagdad, etc.

Constituents.—Cellulose, Soluble gum, Bassorin (traganthin, adraganthin), $C_{12}H_{10}O_{10}$, Polyarabinantrigalactan-geddic acids, Starch, nitrogenous matter, α-tragacanthan-xylan-bassoric acid, xylan-bassoric acid, bassoric acid, β-tragacanthan-xylan-bassoric acid, ash 3.5 p. c. (more than one-half being calcium carbonate).

Cellulose.—The portion of gum insoluble in boiling water, in cold diluted acids and alkalies; when treated with boiling diluted sulphuric acid yields arabinose, and a cellulosic residue which is soluble in ammonia and bromine.

Soluble Gum.—Not identical with arabin, although its solution is precipitated by alcohol and ammonium oxalate; yields a series of gum acids having the nature of the "geddic acids," but are levorotatory, whereas geddic acids are dextrorotatory.

Bassorin.—This is an acid—soluble in hydrochloric acid, ammonia water; when acted upon by an excess of alkali yields a barium salt and two isomeric acids—α- and β-tragacanthan-xylan-bassoric acid, the former soluble in cold water and yielding sparingly soluble salts of barium, calcium, and silver; when digested with diluted sulphuric acid yields tragacanthose and xylan-bassoric acid, which when further acted on by 5 p. c. sulphuric acid yields xylan and bassoric acid.

PREPARATIONS.—1. *Mucilago Tragacanthæ.* Mucilage of Tragacanth. (Syn., Mucil. Trag.; Fr. Mucilage de Gomme Adragante; Ger. Traganthschleim.)

Manufacture: 6 p. c. Mix glycerin 18 Gm. with water 75 cc. in a tared vessel, heat to boiling, remove heat, add tragacanth 6 Gm., macerate 24 hours, stirring occasionally, add water q. s. 100 Gm., heat until uniform consistence, strain forcibly through muslin. Dose, ʒ j–2 (30–60 cc.).

2. *Glyceritum Tragacanthæ, N.F.*, 12.5 p. c., + glycerin 77.5, water 18.5. 3. *Pilulæ Ferri Carbonatis*, $\frac{1}{6}$ gr. (.01 Gm.). 4. *Trochisci Acidi Tannici*, $\frac{1}{3}$ gr. (.02 Gm.). 5. *Trochisci Ammonii Chloridi*, $\frac{1}{3}$ gr. (.02 Gm. 6. *Emulsum Olei Morrhuæ cum Malto, N.F.*, $\frac{3}{10}$ p. c. 7. *Stili Acidi Salicylici, N.F.*, 5 p. c. 8. *Syrupus Trifolii Compositus, N.F.*, $\frac{1}{10}$ p. c. 9. *Trochisci Eucalypti Gummi, N.F.*, 1 gr. (.06 Gm.). 10. *Trochisci Ulmi, N.F.*, $\frac{1}{6}$ gr. (.1 Gm.).

Unoff. Preps.: Pills, Troches—various kinds.

PROPERTIES.—Demulcent, emollient, protective, nutritious.

USES.—Was not known to the Greeks until 4th-5th century, when its uses were as now—expectorant, for cough, hoarseness, similar to acacia; its superior adhesiveness over the latter renders it a better protective in excoriated surfaces, ulcers, burns, etc. Employed largely for suspending resins, oils, heavy powders, etc., in emulsion. Also to cohere pills (paste: ʒ j + glycerin ʒ j; 4 Gm., + 30 Gm.), troches, etc.; its partial insolubility in the stomach restricts somewhat its popularity.

Allied Plants:

1. *Astragalus bæ'ticus.*—Mediterranean basin; seed used for coffee. *A. exsca'pus;* C. and S. Europe, mountains; root mucilaginous, astringent, bitter, diuretic. *A. glycyphyl'los*, Europe; leaves and seed sweetish, diuretic. *A. crotala'riæ, Loco Weed, Rattle Weed*, and *A. mollis'simus*, N. America (Cal., Neb., Tex.); poisonous to cattle, horses, etc., causing spinal tetanic action.

GLYCYRRHIZA. GLYCYRRHIZA, *U.S.P.*

Glycyrrhiza glabra, *Linné*, + var. { **typica,** *Regel et Herder*, **glandulifera,** *Regel et Herder*, or other varieties yielding a yellow sweet wood. }

The dried rhizome and roots with not more than 2.5 p. c. of acid-insoluble ash.

Habitat. S. Europe, W. Asia, Syria, Persia, N. Africa; cult. in Russia, Spain, England, France, Germany, United States, China; rich low-lands, river valleys.

Syn. Glycyrrh., Liquorice Root, Licorice, Sweet Wood, Italian Juice Root (Wood), Spanish Juice Root, Radix Glycyrrhizæ Hispanicæ; Br. Glycyrrhizæ Radix; Fr. Réglisse, Bois de Réglisse —doux, Racine douce; Ger. Radix Liquiritiæ, Süssholz, Spanisches Süssholz, Lakritzenholz.

Glyc-yr-rhi'za. L. fr. Gr. γλυκύρριζα—γλυκός, sweet, +ρίζα, root—*i. e.*, its saccharine taste (Dioscorides).

Gla'bra. L. *glaber*, smooth, hairless—*i. e.*, pods, leaves smooth on both sides.

Glan-du-lif'e-ra. L. *glandula*, a gland, + *ferre*, to bear—*i. e.*, pods covered with thick glandular spines.

Ty'pi-ca. L. *typicus*, typical, representative—*i. e.*, possessing the strongest characteristics of its group.

Lic'o-rice—Liq'uo-rice (lik'o-ris). Fr. L. *liquiritia*, corruption of *glycyrrhiza.*

Plants.—Perennial herbs; stem .6–1.5 M. (2–5°) high, several from the (crown) thick rhizome; leaves imparipinnate; leaflets 4–7 pairs, ovate, entire, smooth, glutinous beneath, dark green; flowers yellowish-white or purplish, pulse-shaped, racemes; fruit legume, 2.5 Cm. (1′) long, brown, ovate, flat, 1-celled, 1–6-(kidney-shape) seeded; *G. glabra*, var. *glandulifera*—stem somewhat pubescent; leaves hairy, glandular beneath; legumes glandular, prickly. Rhizome (*G. glabra*, var. *typica*): *Spanish*, nearly cylindrical, upper portion somewhat knotty, usually in pieces 14–20 Cm. (6–8′) long, 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) thick, yellowish-brown to dark brown, longitudinally wrinkled; thinner rhizomes often having prominent alternate buds, thicker having distinct corky patches; fracture coarsely fibrous; internally yellow, radiate; bark 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}$′) thick; wood porous, in narrow wedges, rhizome with small pith—none in roots; odor distinctive; taste sweetish, slightly acrid—bark; (*G. glabra*, var. *glandulifera*): *Russian*, nearly cylindrical, somewhat tapering, sometimes split longitudinally, 15–30 Cm. (6–12′) long, 1–5 Cm. ($\frac{2}{5}$–2′) thick, pale yellow when deprived of outer corky layer; fracture coarsely fibrous; internally pale yellow; wood radially cleft; less sweet than preceding. Powder, brownish-yellow with reddish-brown cork cells (Spanish); pale yellow without reddish-brown cork cells (Russian)—numerous wood-fibers, bast-fibers, and starch grains, .002–.02 Mm. ($\frac{1}{12500}$–$\frac{1}{1250}$′) broad, tracheæ, crystal-fibers with monoclinic calcium oxalate prisms. *Solvents:* water, diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—The one variety of the root with the other, as they often are collected together; also the underground stem, which resembles the root, but has a thin central pith; roots of allied species (wood not yellow nor sweet), worm-eaten, decayed and discolored pieces, fibrous roots (little sweetness).

Commercial.—Plants, like lemon and orange, do not thrive in cold latitudes, becoming woody and less sweet, and while formerly the wild grown, owing to hardy, persistent rapacious habit, supplied the demand, now it is cultivated extensively by planting cuttings in rows, 4 feet (1.3 M.) apart. Roots are dug when sweetest, autumn of 4th year—preferably of plants that have not borne fruit, a process that exhausts the sweetness of the sap, by removing the earth 2–3 feet (.6–1 M.)

deep, the entire length of rows, thereby exposing subterranean portion and allowing easy pulling up of whole plants, from which roots are taken, cleaned, washed, trimmed, assorted, cut into suitable lengths, and marketed via Alicante, Tortosa, Hamburg, in bundles, bales, bags. There are two varieties: 1, *Spanish* (*Italian, Turkish, Alicante, Tortosa—G. glabra*, var. *typica*), usually *unpeeled* and for a long time most esteemed, but as bitterness and acridity reside in the bark it now constitutes only one-tenth of that consumed; 2, *Russian* (*G. glabra*, var. *glandulifera*), usually *peeled*, larger, richer in glycyrrhizin and extractives, and in far greater demand. The Calabrian is preferred by many, while the Italian and Sicilian are consumed at home for making the extract.

FIG. 199.—*Glycyrrhiza glabra*, var. *typica*.

CONSTITUENTS.—Glycyrrhizin, $C_{44}H_{63}O_{18}N$, 6–8 p. c., Glycyramarin, $C_{36}H_{57}O_{13}N$ (bitter principle, mostly in the bark), sucrose, glucose, asparagin 2–4 p. c., fat .8 p. c., volatile oil .03 p. c., gum, tannin, starch, resin, yellow coloring matter, ash 5–7 p. c.

Glycyrrhizin.—This is combined with ammonia, being called glycyrrhizate of ammonium or glycyrrhizic acid, $C_{44}H_{62}O_{18}N.NH_4$. It is a tribasic acid (glucoside) obtained from cold infusion by coagulating

albumin with heat, filtering, precipitating with sulphuric acid, washing precipitate with water, dissolving it in alcohol to which a little ether has been added (or in very weak ammonia water, 1 to 10), filtering, evaporating; it is very soluble in water, sparingly in alcohol, ether, when boiled with diluted sulphuric acid (by hydrolysis) splits into parasaccharic acid (glucose), $C_6H_{10}O_8$, and bitter resinous glycyrrhetin, $C_{32}H_{47}O_4N$.

FIG. 200.—*Glycyrrhiza glabra*, var. *typica* (rhizome), natural size.

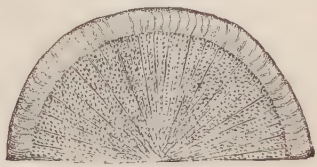


FIG. 201.—*Glycyrrhiza glabra*, var. *glandulifera* (root).

PREPARATIONS.—1. *Extractum Glycyrrhizæ.* Extract of Glycyrrhiza. (Syn., Ext. Glycyrrh., Extract of Licorice, Extractum liquiritiæ, Licorice; Fr. Suc (jus) de Réglisse, Sucre noir; Ger. Succus Liquiritiæ, Süssholzsaft, Lakritz, Lakritzensaft.)

Manufacture: Evaporate decoction to proper consistence, pulverize or mold. This is the commercial extract, in flattened, cylindrical masses or rolls, 15–18 Cm. (6–7′) long, 15–30 Mm. ($\frac{3}{5}$–$1\frac{1}{5}$′) thick, glossy black, brittle, sharp, smooth, conchoidal fracture; characteristic, sweet taste; yield 26–32 p. c., containing glycyrrhizin 10–24 p. c.; at least 60 p. c. soluble in cold water; powder brown; ash 8 p. c. Dose, *ad libitum.*

Preps.: 1. *Trochisci Ammonii Chloridi*, 3 gr. (.2 Gm.). 2. *Pilulæ Ferri Iodidi, N.F.*, $\frac{1}{6}$ gr. (.01 Gm.).

2. *Extractum Glycyrrhizæ Purum.* Pure Extract of Glycyrrhiza. (Syn., Ext. Glycyrrh. Pur., Pure Extract of Licorice Root; Br. Extractum Glycyrrhizæ, Extractum Glycyrrhizæ Depuratum; Fr. Extrait de Réglisse (pur); Ger. Succus Liquiritiæ depuratus, Gereinigter Süssholzsaft.)

Manufacture: Macerate, percolate, in metallic percolator, 100 Gm. with boiling water until exhausted, promptly evaporate to a pilular consistency; yield 16–25 p. c. Dose, *ad libitum.*

Prep.: 1. *Fluidextractum Cascaræ Sagradæ Aromaticum*, 4 p. c.

3. *Fluidextractum Glycyrrhizæ.* Fluidextract of Glycyrrhiza. (Syn., Fldext. Glycyrrh., Fluidextract of Licorice, Fluid Extract of Glycyrrhiza; Br. Extractum Glycyrrhizæ Liquidum; Fr. Extrait fluide de Réglisse; Ger. Süssholzfluidextrakt.)

Manufacture: Macerate 100 Gm. + 500 cc. boiling water 2 hours, pack in a tinned or enameled metallic percolator, exhaust with boiling water, promptly evaporate to 75 cc., cool, add alcohol 25 cc., mix, allow to stand 7 days in a stoppered container, decant clear liquid, filter remainder, wash residue with mixture alcohol 1, water 3, q. s. 100 cc. Dose, ℥xv–60 (1–4 cc.).

PAPILIONACEÆ

Preps.: 1. *Elixir Glycyrrhizæ.* Elixir of Glycyrrhiza. (Syn., Elix. Glycyrrh., Elixir Adjuvans, Elixir of Licorice, Flavoring Elixir; Fr. Elixir de Réglisse—adjuvant; Ger. Gewürzhaftes Lakritzenelixir.)

Manufacture: Mix fluidextract of glycyrrhiza 12.5 cc. with aromatic elixir 87.5 cc., filter. Dose. *ad libitum;* as a flavoring vehicle.

2. *Mistura Glycyrrhizæ Composita.* Compound Mixture of Glycyrrhiza. (Syn., Mist. Glycyrrh. Co., Brown Mixture; Fr. Mixture de Réglisse; Ger. Lakritzenmixtur.)

Manufacture: Dilute fluidextract of glycyrrhiza 12 cc. with glycerin 12, water 50, add antimony and potassium tartrate .024 Gm., dissolved in hot water 1.2 cc., then camphorated tincture of opium 12, spirit of nitrous ether 3, and water q. s. 100 cc., mix. Dose, ℥ss–4 (2–15 cc.).

3. *Syrupus Sarsaparillæ Compositus,* 1.5 p. c. 4. *Elixir Glycyrrhizæ Aquosum, N.F.,* 15 p. c.: Prep.: 1. *Elixir Cascaræ Sagradæ, N.F.,* 50 p. c. 5. *Elixir Taraxaci Compositum, N.F.,* 6 p. c.

4. *Pulvis Glycyrrhizæ Compositus.* Compound Powder of Glycyrrhiza. (Syn., Pulv. Glycyrrh. Co., Compound Licorice Powder; Fr. Poudre pectorale de Réglisse composée; Ger. Pulvis Liquiritiæ compositus (Pectoralis Kurellæ), Brustpulver.)

Manufacture: Mix oil of fennel .4 Gm. with sucrose 50 Gm., add glycyrrhiza 23.6, senna 18, washed sulphur 8; mix thoroughly, pass through No. 80 sieve. It is greenish-yellow, fennel-like odor—fragments of glycyrrhiza with yellow fibers, crystal-fibers, large tracheæ, starch grains, .002–.02 Mm. ($\frac{1}{1250}$–$\frac{1}{1250}$′) broad; fragments of senna with non-glandular hairs, epidermis, stomata with 2 neighboring cells, crystal-fibers. *Tests:* 1. Moisten .1 Gm. with alcohol 2 cc., + water 10 cc., boil, cool, filter; filtrate—pale yellowish-brown; + 1 drop of potassium hydroxide T. S.—changes at once to yellowish-red; should be free from hydrogen sulphide odor. Dose, ℥ss–2 (2–8 Gm.).

5. *Massa Hydrargyri,* 10 p. c.

6. *Fluidglyceratum Glycyrrhizæ, N.F.,* 100 p. c.

Preps.: 1. *Syrupus Glycyrrhizæ, N.F.,* 25 p. c., + syrup q. s. 100; or macerate root (20) in water (100) + ammonia water (10) for 12 hours, filter, add syrup q. s. 100 parts; or mix fluidextract (2) with syrup (8). Dose, *ad libitum;* mostly for flavoring; 2. *Elixir Bromidorum Quinque, N.F.,* 8 p. c.; 3. *Elixir Guaranæ et Apii, N.F.,* 3 p. c.

7. *Fluidextractum Sarsaparillæ Compositum, N.F.,* 12 p. c. 8. *Fluidextractum Trifolii Compositum, N.F.,* 21.5 p. c. 9. *Pilulæ Ferri Iodidi, N.F.,* ⅔ gr. (.045 Gm.). 10. *Pilulæ Laxativæ Compositæ, N.F.,* ⅔ gr. (.045 Gm.). 11. *Species Pectorales, N.F.,* 15 p. c. 12. *Tinctura Aloes, N.F.,* 20 p. c. 13. *Tinctura Aloes et Myrrhæ, N.F.,* 10 p. c. 14. *Tinctura Rhei Dulcis, N.F.,* 4 p. c.

Unoff. Preps.: Ammoniated Glycyrrhizin, gr. 5–15 (.3–1 Gm.). Decoction, Infusion, each, 5 p. c.

Properties.—Demulcent, expectorant, laxative; locally—slight stimulant. Increases, when chewed, the flow of saliva and mucus, which secretions are emollient to the throat.

Uses.—Febrile catarrhal conditions, bronchitis, bowel and urinary affections; here should be prepared with flaxseed, rice, barley, or gum water. In pharmacy used to mask taste of aloe, ammonium chloride, bitter sulphates, colocynth, guaiacum, hyoscyamus, mezereum, senega, senna, quinine, turpentine, etc. Mechanically as an excipient and dryer in pills, troches, etc.

Allied Plants:

1. *Glycyrrhiza echina'ta.*—Europe, Hungary, S. Russia; flowers in globular heads, pod ovoid with long spines. *G. lepido'ta;* United States (Mo., Minn.).

2. *Abrus precato'rius, Indian (Wild) Licorice, Jequirity,* India, Brazil.—Seed used as standard weight, and for criminal poisoning, although inert when taken whole; contain *abrin,* having the action of snake-venom, being cardiac depressant; root contains glycyrrhizin, but is a poor substitute for glycyrrhiza.

3. *Ono'nis spino'sa, Rest-harrow,* Europe.—Root .6 M. (2°) long, 12 Mm. ($\frac{1}{2}$′) thick; odor and taste similar to official glycyrrhiza.

4. *Ar'achis hypogæ'a, Peanut, Groundnut.*—Tropical America, cult. United States. Small succulent plant, yielding abundant subterranean seed, which are edible, popular and contains fixed oil 45 p. c. suitable for replacing sesame or olive oil.

SANTALUM RUBRUM. RED SAUNDERS, *U.S.P.*

Pterocarpus santalinus, *Linné filius.* } The heart-wood.

Habitat. Madras; cultivated in S. India, Ceylon, Philippines.

Syn. Santal. Rub.; Red Santal, Chandam, Chundana, Ruby Wood; Br. Pterocarpi Lignum, Red Saunders (Sandal) Wood; Fr. Santal Rouge; Ger. Rothes Sandelholz.

Pter-o-car'pus. L. from Gr. *πτερόν* wing, + *καρπός* fruit—*i. e.*, its winged fruit pods or legumes girdled with a broad crisped wing.

San-ta-li'nus. L. adj. form fr. *sandal,* Pers. *sandal,* useful; Gr. *σάνταλον.*

San'ta-lum. L. noun form; sandalwood, saunders.

Ru'brum. L. *ruber,* red, ruddy—*i. e.*, the color of the wood.

Plant.—Tree 6–9 M. (20–30°) high, .3–.5 M. (12–18′) thick, some trunks hollow; leaves trifoliate; leaflets broadly oval, emarginate, 5–15 Cm. (2–6′) long, hoary beneath; flowers yellow, papilionaceous corolla, spikes; fruit orbicular legume, wing slightly crisped, 2-seeded. Heart-wood, in billets, logs, 1–1.6 M. (3–5°) long, 10–20 Cm. (4–8′) thick, deprived of light-colored sap-wood, hard, heavy, dark reddish-brown, splitting coarse-splintery; usually in coarse

powder, purplish to brownish-red, nearly odorless and tasteless. Powder, reddish-brown—numerous wood-fibers of irregular outline and sharp pointed ends, occasionally forked, lumina filled with fine, granular protoplasmic content, occasional tracheæ filled with yellow, resinous masses, medullary rays 1 cell wide, 3–6 deep, crystal-fibers with prisms of calcium oxalate; mounts in chloral hydrate T. S.—deep, rich red color. *Tests:* 1. Mix .5 Gm. with ether 10 cc.—solution orange-yellow, with greenish fluorescence in bright light; .5 Gm. with alcohol 10 cc.—solution distinctly red. 2. Mix .5 Gm. with water 10 cc.—liquid clear and colorless. *Solvents:* alcohol; ether; acetic acid; alkaline solutions; boiling water or diluted alcohol partially.

Preparation.—1. *Tinctura Lavandulæ Composita*, 1 p. c.

Constituents.—Santalin .25–.5 p. c., Santal, Pterocarpin, Homopterocarpin.

Santalin (*santalic acid*), $C_{17}H_{16}O_5$.—Coloring matter, obtained by precipitating alcoholic tincture with lead acetate, washing precipitate with hot alcohol, decomposing it with hydrogen sulphide in the presence of alcohol, evaporating; occurs in red needles, inodorous, tasteless, resinous, soluble in alcohol (blood-red), ether (yellow), sulphuric acid (deep red), alkalies (violet), also in oils of clove, cinnamon, bergamot, bitter almond.

Santal, $C_8H_6O_3$, **Pterocarpin,** $C_{20}H_{16}O_6$, **Homopterocarpin,** $C_{24}H_{24}O_6$—All occur in colorless scales—the latter soluble in carbon disulphide and when fused with potassium hydroxide yields phloroglucin.

Uses.—Red Saunders has no important medicinal properties, being used only for imparting color. Employed natively as an astringent and with sapan wood for dyeing silk, cotton, wool, giving various reds according to mordants used.

Allied Plants:

1. *Ichthyome'thia Piscip'ula* (*Piscid'ia Erythri'na*), *Jamaica Dogwood.*—W. Indies. Well-developed tree, whose root-bark has long been used for catching fish, orange-yellow, fissured, tough, fibrous, odor opium-like, taste bitter, acrid; contains piscidin piscidic acid, resin, starch, fat. Narcotic, analgesic, soporific; neuralgia, nervous insomnia, whooping cough, dysmenorrhea; similar to opium, but less powerful, and devoid of unpleasant after-effects. Dose, ʒss–1 (2–4 Gm.); extract, fluidextract.

KINO. KINO, *U.S.P.*

Pterocarpus Marsupium, *Roxburgh.*

The dried juice from the trunk, yielding not less than 45 p. c. alcohol-soluble extractive, or 80 p. c. water-soluble extractive.

Habitat. E. India, in forests; C. and S. India (Malabar), Ceylon, Bengal.

Syn. Gummi (Resina) Kino, Vengay, Bastard Teak, Bija, Amboyna Kino Tree; Br. Kino, Kino Eucalypti (Eucalyptus (Red) Gum); Fr. Kino de l'Inde; Ger. Kino.

Mar-su'pi-um. L. *marsupium*, a pouch, bag, purse—*i. e.*, shape of the fruit.

Ki'no. E. India name as given the extract.

PLANT.—Large tree, 18–24 M. (60–80°) high, .6–1 M. (2–3°) thick, many spreading branches; bark brownish-gray, internally red and fibrous; leaves alternate, imparipinnate, deciduous; leaflets 5–7, alternate, 5–10 Cm. (2–4′) long, obovate, emarginate, coriaceous; flowers May–June, pale yellow; fruit indehiscent pod, orbicular, 2.5–4 Cm. (1–1$\frac{3}{5}$′) broad; seed 1, kidney-shaped. JUICE (kino), in small, brittle, angular fragments, usually less than 10 Mm. ($\frac{2}{5}$′) broad, dark reddish-brown, reddish-black; inodorous; taste very astringent; upon mastication coloring saliva pink. POWDER, dark red—angular fragments, with glass-like, conchoidal surface, thinner pieces translucent, yellowish-red, brownish-red; mounted in water—fragments rounded, gradually disintegrate, leaving colorless, granular particles, some being rod-shaped bacteria and a few cellular fragments; mounted in alcohol—red color of fragments deepens, translucency increases, the angular outlines being preserved while solution takes place. *Tests:* 1. Add boiling water, cool, filtrate faintly acid; with ferric chloride T. S.—dark green precipitate; with alkalies—reddish-violet color. *Solvents:* alcohol, to the extent of 90 p. c.; boiling water to the extent of 40–80 p. c.; alkalies, with impairment of astringency. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—Inferior juices, catechu, dragon's blood (insoluble in water), kinos containing gum (swelling in water, alcohol), etc.

Commercial.—Plant, called natively *Buja,* is prized for fine timber and juice, the privilege of tapping trees for the latter being granted by the government to highest bidders; it is collected to some extent the entire year, but chiefly during inflorescence, dry season, February–March (when it is better and easier dried), by cutting into the tree-trunk to the cambium a perpendicular incision and lateral feeders; the juice, resembling currant-jelly, exudes freely into clay cups, bamboo-joints, etc., placed at the bottom of main incision, when it is dried in the sun and air (inspissated) or boiled to the consistency of a thick extract, occasionally skimming off impurities, then poured into shallow pans to dry until crumbly (half-inch layer requiring a week) and packed in wooden boxes for market. Trees yield most at night and when small often are killed by excessive bleeding, which may be averted by resting alternate years; each produces about 24 ounces (.7 Kg.) that upon evaporation becomes half as much kino. Liquid preparations, especially in diluted alcohol tend to gelatinize (with loss of astringency) from presence of an enzyme—destroyed by boiling—and should be kept in small bottles and seldom opened; the menstruum making a permanent solution is alcohol 65, water 20, glycerin 15 volumes, although alcohol 50, water 25, glycerin 25 usually gives satisfaction. There are several varieties: 1, *Malabar* (*E. India*), official, described above, rarely found on the market; 2, *African* (*Gambia—P. erina′ceus*), similar to preceding, not in our market but common in England; contains tannin 50–60 p. c.; 3, *Bengal* (*Palas, Buteæ Gummi* (Br.)—*Bu′tea frondo′sa*) in transparent ruby-red tears,

PAPILIONACEÆ

fragments, often with leaf-vein impressions, brittle, not adhesive on mastication, yields pyrocatechin on dry distillation, one-third to one-half soluble in hot alcohol, the remainder being mucilaginous matter; contains tannin 15–35 p. c.; 4, *Australian* (*Botany Bay, Kino Eucalypti* (Br.)—*Eucalyptus rostra'ta, E. amygdalina, E. resinif'era,* and other species of Myrtaceæ), not very brittle, adheres to teeth, tinges saliva red, soluble in alcohol, 80–90 p. c., in water, lessening with age, furnishes much of the present commercial kino; contains tannin 45–50 p. c.; 5, *W. India* (*Jamaica, Caracas—Coccol'oba uvif'era,* Polygonaceæ), obtained by boiling the violet-brown wood and bark of the large tree, evaporating the decoction; resembles official but has brownish tint, less glossy, bitter, soluble in water, alcohol (90 p. c.); contains tannin 70 p. c.

FIG. 202.—*Pterocarpus Marsupium* (Kino): *A*, flowering twig; *1, 2, 3*, parts of the flower; *4*, stamens; *5*, pistil; *6*, fruit; *7*, vertical section of winged fruit.

CONSTITUENTS.—Kino-tannic acid, $C_{18}H_{18}O_8$, 40–80 p. c., Kino-red, $C_{28}H_{22}O_{11}$, Pyrocatechin (pyrocatechuic acid, catechol), $C_6H_6O_2$, Kinoin, $C_{14}H_{12}O_6$, gum, ash 1.3–3 p. c.

Kino-tannic Acid.—Similar to catechuic acid, always mixed with coloring matter and pectin in extraction; with ferric salts—greenish-black, with ferrous salts in neutral solutions—violet color.

Kino-red.—Obtained by exposing cold aqueous solution to the air, when red precipitate slowly forms, hastened by heating, or heat kinoin to 130° C. (266° F.); it is amorphous, tasteless, nearly insoluble in water, and is the anhydride of kinoin: $2C_{14}H_{12}O_6 - H_2O = C_{28}H_{22}O_{11}$.

Pyrocatechin.—Obtained by treating kino with ether, or the product of dry distillation of kino contains much of it, which may be purified by resublimation; soluble in ether, water.

Kinoin.—Boil kino with diluted hydrochloric acid, kino-red immediately separates, now agitate clear solution with ether; occurs in white crystals, slightly soluble in ether, cold water, red with ferric chloride.

PREPARATIONS.—1. *Tinctura Kino.* Tincture of Kino. (Syn., Tr. Kino; Fr. Teinture de Kino; Ger. Kinotinktur.)

Manufacture: 10 p. c. Agitate thoroughly in a flask 10 Gm. with boiling water 50 cc., heat for 1 hour on water-bath containing boiling water, shaking frequently, cool, add recently boiled water q. s. 50 cc., then add alcohol 50 cc., stopper flask, set aside in cool place for 24 hours, decant through cheesecloth. Should be kept cool, dark, in small, tightly-stoppered bottles. Dose, ʒss–2 (2–8 cc.).

Unoff. Preps.: Compound Powder of Kino and Opium, 75 p. c., + opium 5, cinnamon 20, dose, gr. 10–15 (.6–1 Gm.). *Compound Tincture of Kino and Opium,* 20 p. c. (tincture), + tincture of opium 10, ʒss–1 (2–4 cc.). Fluidextract, Infusion, Gargle.

Owing to gum (pectin) coagulating, the liquid preparations are very unstable, consequently catechu often is used instead with equally good results.

PROPERTIES.—Astringent, tonic, hemostatic; similar to but less powerful than tannin; locally inferior to other astringents.

USES.—Diarrhea, pyrosis, menorrhagia, dysentery, leucorrhea, ulcers, sore throat, epistaxis, hemorrhages, diabetes, manufacture of wines. Useful in dyeing and tanning, but rather too expensive.

Incompatibles: Aqueous solution is precipitated by gelatin, soluble salts of iron, silver, lead, antimony, mercuric chloride, sulphuric, nitric, and hydrochloric acids.

ARAROBA. GOA POWDER, *Br.*

Chrysarobinum. Chrysarobin, $C_{30}H_{26}O_7$, *U.S.P.*

Vouacapoua Araroba, *(Aguiar) Druce.* { A mixture of neutral principles obtained from Goa Powder, a substance deposited in the wood (of this plant).

Habitat. Brazil, Bahia; in damp forests.

Syn. Araroba or Arariba Tree, Po(h)de Bahia, Crude Chrysarobin; Chrysarob.; Fr. Poudre de Goa, Chrysarobine; Ger. Goa Pulvre, Chrysarobin.

Vou-a-ca-pou'a. L. fr. native C. American name (nomen caribæum), *voicápou.*

Ar-a-ro'ba. L. fr. E. India name, *ar(ar)oba,* as applied to the bark.

Chrys-ar-o-bi'num. L. for *Chry-sar'o-bin,* fr. Gr. χρυσός, gold, + *ar(ar)oba.*

Go'a. After Portuguese colony of Goa, on the Malabar coast of India, to which it was imported from Bahia, in Brazil, 1852.

PLANT.—Large tree 24–30 M. (80–100°) high; trunk smooth, spheroidal, head not very bushy; leaves paripinnate, with long petioles; flowers purple, paniculate racemes; wood yellow, with numerous longitudinal canals and many irregular transverse interspaces or lacunæ

in which the Goa Powder is found—a result of decay or chemical changes in the cell-walls of the trunk-wood (medullary rays), being possibly an antiseptic preservative of the plant; yields much chrysophanic acid by oxidation.

Commercial.—Tree resembles the copaiba, and is called natively *Angelim Amargoso;* the oldest yield most powder, which is obtained by felling, splitting the tree, and then scraping the powder from the clefts, those doing this often suffering with irritated eyes and face; occurs as a light yellow powder when fresh, but brownish on exposure, slightly crystalline, rough, mixed with wood fibers, inodorous, bitter; 7 p. c. soluble in water, 80 p. c. in benzene, 50 p. c. in hot chloroform.

CONSTITUENTS.—GOA POWDER: Chrysarobin 65–85 p. c., gum 7 p. c., resin 2 p. c., bitter extractive 7 p. c., woody fiber 5 p. c., ash .3–3 p. c.

Chrysarobinum. Chrysarobin.—Obtained by treating Goa Powder with hot benzene (hot chloroform), evaporating to dryness, powdering. It is a brownish, orange-yellow, microcrystalline powder, tasteless, odorless, irritating mucous membrane, soluble in alcohol (385), chloroform (13), ether (160), benzene (30), carbon disulphide (180), solutions of fixed alkali hydroxides (red), slightly in water and boiling water—neutral; contains methyl chrysarobin in varying percentage, and is a reduced quinone. *Tests:* 1. Dissolve in sulphuric acid—deep red solution, which poured into water deposits chrysarobin unchanged. 2. Incinerate—ash .25 p. c.; shake 1 Gm. with potassium hydroxide T. S. (10)—yellow, yellowish-red, deep red, due to absorbing oxygen from the air, producing chrysophanic acid—$C_{30}H_{26}O_7+O_4 = 2C_{15}H_{10}O_4 +3H_2O$, or inversely—$2C_{15}H_{10}O_4+H_8=C_{30}H_{26}O_7+H_2O$. 3. Mix .002 Gm. with 2 drops of fuming nitric acid—red mixture, turning violet-red with a few drops of ammonia T. S. (dif. from chrysophanic acid—yellow liquid). Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$ (.008 Gm.).

PREPARATION.—1. *Unguentum Chrysarobini.* Chrysarobin Ointment. (Syn., Ung. Chrysarob.; Fr. Pommade de Chrysarobine; Ger. Chrysarobinsalbe.)

Manufacture: 6 p. c. Triturate chrysarobin 6 Gm. with hydrous wool fat 94 Gm. previously melted, heat on water-bath for 20 minutes, stirring occasionally, strain (thereby removing about 1 p. c.), stir until congealed.

PROPERTIES.—Irritant, in doses of gr. 20 (1.3 Gm.) gastro-intestinal irritant, causing large watery, bilious stools, vomiting, nausea. Externally—produces diffuse dermatitis, followed by follicular and furuncular inflammation; stains skin dark brown, removed by chlorinated lime.

USES.—Parasitic skin diseases of vegetable origin, ringworm, acne, favus, psoriasis, chronic eczema, hemorrhoids—ointment; solution in water, vinegar, or chloroform—allowed to dry then cover with collodion; suppositories, 1 gr. (.06 Gm.)—hemorrhoids.

Allied Compounds:

1. *Anthrarobin* (*Desoxyalizarin*), $C_{14}H_{10}O_3$.—Obtained from the coal-tar product alizarin by action of nascent hydrogen; it is a strong deoxidizing agent, miscible with fats, weaker, less irritating and toxic than chrysarobin, soluble in alcohol, glycerin.

2. *Hydroxylamine Hydrochloride*, NH_2OHHCl.—This does not stain the skin, hence is preferred often to the other reducing agents (chrysarobin, pyrogallol, anthrarobin, etc.) in skin diseases, but being a poison, care should be exercised not to allow too much to be absorbed by the system.

Allied Plants:

1. *Coumarou'na* (*Dip'teryx*) *odora'ta, Tonka Bean; Coumarinum, Coumarin, N.F.*—The anhydride of ortho-oxycinnamic acid occurring naturally in this plant, also in *Melilo'tus officina'lis* and others, or prepared synthetically; Guiana. Large tree; fruit resembles mango, peach, oblong-ovate, single-seeded; seed 4 Cm. ($1\frac{3}{5}'$) long, compressed, rounded at each end, testa dark brown, thin, wrinkled, somewhat glossy, often covered with small white crystals (coumarin); kernel brownish, oily; odor agreeably aromatic, resembling vanilla; taste bitter, aromatic. There are two varieties: 1, Dutch; 2, English; contains coumarin (odorous principle) 1.5–2 p. c., fixed oil 25 p. c., sugar, mucilage. Coumarin, $C_9H_6O_2$—developed in process of curing by steeping seed in rum, or 80 p. c. alcohol, for 1–2 days, concentrating, adding water to separate fixed oil; occurs in colorless, prismatic crystals, characteristic fragrant odor, bitter, aromatic, burning taste; soluble in alcohol, ether, chloroform, fixed or volatile oils, sparingly in water, more readily in hot water. Saturated aqueous solution + iodine T. S. —brown, flocculent precipitate, which clots on shaking, forming dark green curdy mass and clear liquid (dist. from vanillin); solution in ether—not extracted by ammonia water (dist. from vanillin). Narcotic, stimulant, insecticide, paralyzant to the heart; whooping-cough (fluidextract), flavoring sachets, cigars, tobacco, butter, perfumery, deodorizing iodoform. Dose, gr. 5–10 (.3–.6 Gm.). Coumarin 65 times stronger; 1. *Oleum Ricini Aromaticum*, $\frac{1}{100}$ p. c.

2. *Glyc'ine* (*So'ja*) *his'pida, Soja Bean.*—Japan, cultivated S. Asia; contains casein 40 p. c., fixed oil 15–20 p. c., dextrin 10, starch 5, cellulose 5, water 10, amylolytic ferment. Owing to the beans containing so little starch they are ground into flour, and made into bread for diabetic patients, in order to decrease sugar in the urine; plant—turned under as a nitrogenous fertilizer to land.

3. *Mucu'na pru'riens, Cowhage, Cowitch.*—Hairs of the pods, U.S.P. 1840–1870; E. and W. Indies. Climbing plant, flowers resemble those of the pea, purple; leaflets hairy; pods coriaceous, shape of italic letter *f*, 10 Cm. (4′) long, covered with brown hairs, 2.5 Mm. ($\frac{1}{10}'$) long, stiff, filled with brown granular matter, readily penetrating the skin, causing violent itching. Detached from pods (which then are eaten as also when green in India) by dipping into honey, scraping into paste; con-

tains resin, tannin. Anthelmintic for round worms; irritant in paralysis; action on worms thought to be mechanical. Dose, gr. 1–3 (.06–.2 Gm.), followed by calomel, jalap; ointment also used.

4. *Flemin'gia rhodocar'pa*, *Wars*, *Wurrus* (Ar. for saffron); E. Africa. Cylindrical glands and long hairs of the fruit—a deep purple powder, coarser than but used instead of kamala; turns black in water, odor slight; contains flemingin, similar to rottlerin.

FIG. 203.—*Mucuna pruriens: a*, flower; *b*, stamen system; *c*, anthers; *d*, filament; *e*, anther.

PHYSOSTIGMA. PHYSOSTIGMA.

Physostigminæ Salicylas. Physostigmine Salicylate, $C_{15}H_{21}O_2N_3.C_7H_6O_3$, *U.S.P.*

Physostigma venenosum, *Balfour.* { The salicylate of an alkaloid obtained from the dried ripe seed.

Habitat. W. Africa (near mouths of Niger and Old Calabar Rivers, in the Gulf of Guinea); introduced into India and Brazil.

Syn. Calabar Bean, Ordeal Bean, Chop Nut, Split Nut; Physostigmatis Semina; Fr. Féve de Calabar; Ger. Faba Calabarica, Kalabarbohne; Physostig. Salicyl., Eserine Salicylate; Fr. Salicylate d'Esérine; Ger. Physostigminum salicylicum, Physostigminsalicylat.

Phy-so-stig'ma. L. fr. Gr. φύσα, a bladder, + στίγμα, stigma—*i. e.*, stigmatic appendage is hollow and inflated.

Ven-e-no'sum. L. *venenosus*, full of poison, poisonous—*i. e.*, plant's property.

Cal'a-bar Bean—*i. e.*, bean from the Calabar district on W. African coast.

PLANT.—Woody, perennial climber; stem 12–15 M. (40–50°) long, 5 Cm. (2′) thick, smooth; root spreading; leaves large, pinnately

trifoliate, leaflets 7.5–15 Cm. (3–6′) long, ovate pointed; flowers purplish, racemes; fruit June–Sept., legume 10–17.5 Cm. (4–7′) long, compressed, pale brown, 2-valved, dehiscent, inside woolly, 2–3-seeded. Seed, oblong, ellipsoidal, somewhat compressed reniform, 15–30 Mm. ($\frac{3}{5}$–$1\frac{1}{5}$′) long, 10–15 Mm. ($\frac{2}{5}$–$\frac{3}{5}$′) broad, 12 Mm. ($\frac{1}{2}$′) thick, reddish, chocolate-brown, smooth, brownish-black groove, 2 Mm. ($\frac{1}{12}$′) wide, extending almost the entire length of convex edge, margins of seed-coat on both sides of the groove somewhat elevated, brownish-red and

Fig. 204.—*Physostigma venenosum.*

thickened; 2 concavo-convex cotyledons; taste at first starchy, afterward acrid. Powder, grayish-white—numerous starch grains, fragments of seed-coat with thick cells resembling stone cells, occasional fragments with tracheæ. Embryo 72 p. c., integuments 28 p. c., the former when moistened with potassium hydroxide T. S.—pale yellow; solvent: alcohol. Dose, gr. 1–4 (.06–.26 Gm.).

Adulterations.—*P. cylindrosper'ma*, seed 4 Cm. ($1\frac{3}{5}$′) long, nearly cylindrical, groove and hilum shorter, not extending quite to the end; *En'tada scan'dens*, seed round, flat, 5 Cm. (2′) broad (poisonous),

PAPILIONACEÆ

also *Elæ'is guineen'sis*, *Oil Palm Seed*, and seeds of *Mucuna* species, none of which resemble Calabar bean.

Commercial.—Plant first noticed medicinally in 1846, and, except ligneous stem, resembles our String and Lima Beans (*Phase'olus multiflo'rus* and *P. luna'tus*), preferring banks of streams into which the fruit often falls only to be dispersed and conveyed to settlers more or less remote.

CONSTITUENTS.—Physostigmine (eserine) .1 p. c., eseridine, physovenine (strong myotic), eseroline, eseramine, $C_{16}H_{25}O_3N$ (crystalline physiologically inactive), calabarine (liquid, not yet obtained pure, antagonistic to physostigmine, tetanic, may cause diarrhea and convulsions, soluble in alcohol, water, insoluble in ether), phytosterin—separable into sitosterin 80 p. c., stigmosterin 20 p. c., which crystallizes with 1 molecule of H_2O, inactive, starch 48 p. c., proteins (albumin) 23 p. c., gum, fat, ash 3–4 p. c.

FIG. 205. — Physostigma: view from the side and edge, showing length of hilum.

FIG. 206.—Physostigma split, showing cotyledons.

FIG. 207.—*Physostigma cylindrosperma.*

Physostigmine, $C_{15}H_{21}O_2N_3$.—Chiefly in embryo; claimed to be a reduction product of geneserine, $C_{15}H_{21}O_3N_3$, and is obtained by mixing powdered bean with 1 p. c. of tartaric acid, exhausting with alcohol, evaporating, treating residue with water, agitating filtrate with ether to remove color, adding sodium bicarbonate, shaking with ether, evaporating, getting colorless, amorphous physostigmine; hygroscopic, liquefies at 45° C. (113° F.), tasteless, soluble in alcohol, ether, chloroform, benzene, carbon disulphide, slightly in water; forms salts (benzoate, citrate, hydrobromide, hydrochloride, nitrate, etc.). With alkalies or chlorinated lime yields red *rubreserine;* with sulphuric acid gives yellow, then olive-green. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Physostigminæ Salicylas. Physostigmine Salicylate, $C_{15}H_{21}O_2N_3.C_7H_6O_3$, *U.S.P.*—Obtained by neutralizing alcoholic or ethereal solution of physostigmine with salicylic acid, allowing to crystallize; it is in colorless, faintly yellow, shining crystals, odorless, acquiring red tint on exposure (must use great caution in tasting); soluble in water (75), hot water (16), alcohol (16), hot alcohol (5), chloroform (6), ether (250);

cold, saturated aqueous solution neutral or faintly acid, usually pink on standing. *Tests:* 1. Aqueous solution with ferric chloride T. S.—deep violet color; solution of .1 Gm. + 2 cc. of sulphuric acid—not darker than yellow within 5 minutes (abs. of readily carbonizable substances). 2. Evaporate .005 Gm. to dryness with a few drops of ammonia T. S.—blue residue, which dissolved in alcohol, + acetic acid in excess—red, fluorescent solution; cold saturated solution 5 cc., + few drops of sodium hydroxide T. S.—pink color rapidly develops; incinerate .1 Gm.—ash negligible. *Impurities:* Sulphate, readily carbonizable substances. Should be kept dark, in small, well-closed containers. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Eseridine, $C_{15}H_{22}O_3N_3$.—By some thought to be calabarine, is a derivative of physostigmine, from which it differs by containing H_2O, and into which it can be converted by dilute acids; obtained from its mother-liquor by precipitating with lead subacetate and ammonia, evaporating filtrate, treating residue with alcohol, precipitating with phosphotungstic acid, decomposing with baryta; occurs in 4-sided crystals, soluble in alcohol, chloroform, ether, acts similar to physostigmine. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

Preparations (Unoff.). Seed: *Extract*, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.), *Tincture*, 10 p. c. (alcohol), ♏v–20 (.3–1.3 cc.). *Lamellæ Physostigminæ* (Br.—sulphate), $\frac{1}{1000}$ gr. (.00006 Gm.).

Properties.—Sedative, myotic, motor depressant, paralyzant, emetic, purgative, diaphoretic, sialagogue, poisonous. Stimulates salivary, gastric, and intestinal secretions, peristalsis, acting directly upon the unstriped muscle-fibers, quickens breathing, then retards it, heart becomes slow and irregular, but more powerful, finally feeble and ceasing altogether, depresses, ultimately paralyzes spinal cord reflex, and motor centers.

Uses.—Tetanus, chorea, epilepsy, progressive paralysis, tonic convulsions, gastralgia, strychnine and atropine poisoning, constipation (combined with belladonna and nux vomica). Externally—in neuralgia, muscular rheumatism, malignant tumors. Physostigmine salicylate ($\frac{1}{2}$ p. c. in water, few drops into eye) for breaking up ocular adhesions (iris, cornea, lens), lessen intra-ocular tension, iritis, corneal ulcers, prolapsed iris, paralysis of the iris accommodation following diphtheria, glaucoma. In Africa as *ordeal bean* of Calabar for punishing criminals and for witchcraft, the accused having to eat them until they vomit or die: if former, innocent; latter, guilty (?). A paste of 20 seed will kill.

Poisoning: Have nausea, giddiness, abdominal pain, indistinct vision, diminished heart action, muscular tremors and weakness, then complete relaxation, retarded respiration, motor paralysis, sphincters contract, cold extremities, skin covered with cholera-like sweat. Conscious until death, which is caused by carbon dioxide narcosis, and paralysis of the respiratory centers and heart-muscle. Evacuate stomach (emetics, pump); give atropine (physiological antidote)

hypodermically, gr. $\frac{1}{3\,0}$ (.002 Gm.); tannin, chloral hydrate (spine), strychnine, diffusible stimulants, coffee, ammonia, digitalis, alcohol, artificial heat and respiration, electricity. Empty bladder often (catheter), as the drug is eliminated by kidneys (bile and saliva), and urine becomes poisonous.

Incompatibles: Vegetable astringents, tannin, caustic alkalies, atropine, chloral hydrate, motor and tetanizing excitants.

Synergists: Motor depressants, conium, gelsemium, amyl nitrite, etc.

Allied Plants:

1. *Gera'nium macula'tum, Geranium, Cranesbill, N.F.*—Geraniaceæ. The dried rhizome with not more than 2 p. c. of foreign organic matter; N. America, rich woods, thickets. Perennial, hairy herb, .3–.6 M. (1–2°) high; leaves palmately 5–7-lobed, each lobe incised at apex, cuneate, hairy, pale green with paler spots; flowers large, purplish, umbels; petals 5, entire; fruit long-beaked. Rhizome, cylindraceous, 2.5–10 Cm. (1–4′) long, 3–15 Mm. ($\frac{1}{8}$–$\frac{3}{5}$′) thick, somewhat branched, bent, flattened, strongly tuberculated, root-scars, wrinkled, dark purple-brown, internally light purple-brown; fracture short, non-

FIG. 208.—*Geranium maculatum:* rhizome and transverse section of rhizome and root, natural size.

fibrous, bark thin, cambium distinct, irregular, wood-wedges, large central pith, few fibro-vascular bundles; odorless; taste strongly astringent. Powder, purplish-brown—cortical and pith parenchyma, starch grains, calcium oxalate rosettes, cork cells with brownish amorphous content, fragments bluish-black with ammonio-ferric alum T. S.; tracheæ, tracheids; solvents: alcohol, water; contains tannin 10–28 p. c., gallic acid, resin, crystalline principle, geranium-red, a phlobaphene formed from the tannin, ash 8 p. c. Astringent, tonic; diarrhea, chronic dysentery, hemorrhages, gleet, leucorrhea, aphthæ, relaxed vagina, throat, uvula, rectum, indolent ulcers. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Geranii* (75 p. c. alcohol). Extract; Tincture; Decoction, 5 p. c. (water or milk); "Eclectic" *geranin.*

2. *G. Robertia'num.*—Europe; popular astringent for hemorrhage, diuretic for gravel. *Ero'dium* (*Geranium*) *moscha'tum, Stork's-bill;* diaphoretic. *E. cicuta'rium, Heron's-bill;* diuretic for dropsy.

35. LINACEÆ. Flax Family.

Li-na'se-e. L. *Lin-um* + aceæ, flax, fr. Celtic *llin*, a thread, whence Gr. λίνον, L. *linum* (classic names), Eng. linen—*i. e.*, its fabric. Herbs. Distinguished by flowers being regular; stamens 5, monadelphous at

base; sepals 5, imbricate, petals 5; ovary 2–5-celled, styles 2–5; fruit capsular, seeds 2 in each cell, albuminous, superior; universal, temperate climates; demulcent, purgative, stimulant, sedative, tonic; fibers, oil.

Genus: **1. Linum.**

LINUM. LINSEED, *U.S.P.*

Linum usitatissimum, *Linné.* { The dried ripe seed with not more than 2 p. c. other seeds or foreign organic matter, yielding not less than 30 p. c. non-volatile, ether-soluble extractive—98 p. c. being saponifiable.

Habitat. C. Asia, Egypt, S. Europe, spontaneous in most temperate countries; cultivated in Russia, Egypt, India, United States, S. Europe, England, Holland.

Syn. Flaxseed, Flax, Lint-bells, Winter lien; Br. Lini Semina, Lini Semina Contusa (Crushed); Fr. Lin, Semence (Graine) de Lin; Ger. Semen Lini, Leinsamen, Flachssamen.

Li'num. L. see etymology, page 330, of Linaceæ.

U-si-ta-tis'si-mum. L. sup. adj. fr. *usitatus*, most useful, common, familiar.

Flax'seed. AS. *fleax, flechten*, to braid, plait, twist—*i. e.*, its fibers, + *seed.*

Plant.—An annual; stem .6 M. (2°) high, stiff, erect, solitary, round, smooth, green; leaves small, lanceolate, acute, entire, sessile, pale green, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}'$) long; flowers June–July; terminal, bluish; fruit August, globular capsule, size of pea, with persistent calyx at base, crowned with sharp spine, 10-seeded in distinct cells. Seed, ovate, oblong-lanceolate, flattened, obliquely pointed at one end, 4–6 Mm. ($\frac{1}{6}$–$\frac{1}{4}'$) long, brown, smooth, shiny, raphe a distinct yellow ridge along one edge, hilum and micropyle in depression below pointed end; internally light yellow, brownish; odor slight; taste mucilaginous, oily. Powder, yellowish-brown—large oil globules, irregular fragments of endosperm and seed-coat, the latter with pigment cells filled with brownish insoluble contents, stone cells with porous walls, aleurone grains. Meal (ground, lini farina, crushed linseed), yellow with numerous brown coarse fragments—seed-coat and kernel. *Test:* 1. Boil 1 Gm. fat-free powder or meal with water 50 cc., cool—filtrate + iodine T. S. not more than faint blue (abs. of starch or starch-bearing seeds). *Solvent:* boiling water. Dose, ʒj–2 (4–8 Gm.).

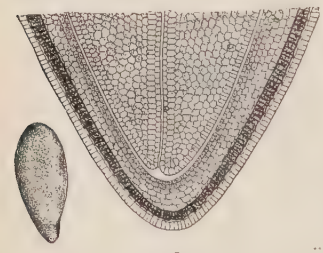
Fig. 209.—*Linum usitatissimum.*

LINACEÆ

ADULTERATIONS.—SEED: Foreign seeds and earthy matter 1–25 p. c.—mustard, rape and other cruciferous seeds, sand, small stones; POWDER: Damaged flour, cornmeal, other starchy substances, recognized by microscope or iodine test; expressed cake and that to which mineral oil has been added.

Commercial.—The flax is of ancient origin, being prized for its fabric and medicinal properties; most of our seed now come from Russia and Germany, but the United States furnishes considerable. When exposed to heat, light, damp atmosphere, or otherwise carelessly preserved, especially the ground, it is subject to insect attack, and should not be used after 1 year old.

CONSTITUENTS.—Fixed oil 35–40 p. c. (in nucleus), Mucilage, $C_{12}H_{20}O_{10}$, 15 p. c. (in integuments—viscid, odorless, nearly tasteless, precipitated by alcohol, lead subacetate, but not by tannin), proteins 25 p. c., tannin, amygdalin (resin, wax, sugar, no starch (except in young seed), ash 4–6 p. c.—phosphates sulphates, chlorides of potassium, calcium, magnesium).



a *b*

FIG. 210.—Flaxseed: *a*, entire magnified 3 diam.; *b*, transverse section near the edge, magnified 65 diam.

Oleum Lini. Linseed Oil, *U.S.P.*—(Syn., Ol. Lini, Oil of Flaxseed, Raw Linseed Oil; Fr. Huile de Lin; Ger. Leinöl, Leinsamenöl.) This fixed oil, usually obtained by drying the seed with heat, crushing, and expressing, is a yellowish, oily liquid, peculiar odor, bland taste; gradually thickens and darkens on exposure, acquiring a pronounced odor and taste; slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, oil of turpentine; slightly acid; sp. gr. 0.930, congeals at —20° C. (—4° F.); consists of liquid glycerides of oleic acid, $C_{18}H_{34}O_2$ (5), linoleic acid, $C_{18}H_{32}O_2$ (15), linolenic acid, $C_{18}H_{30}O_2$ (15), and isolinoleic acid, $C_{18}H_{32}O_2$ (65) 85–90 p. c., also a mixture of palmitin, myristin, and stearin 10–15 p. c.; also claimed to consist chiefly of linoleic acid, 22–25 p. c. of linolenic acid, and 5 p. c. of solid fatty acids; 1 p. c. of non-saponifiable matter. Linolein, the glyceride of linoleic acid, is considered the drying constituent, which on exposure is converted into oxylinoleic acid hydrate, and finally into linoxyn, $C_{32}H_{54}O_{11}$ (insoluble in ether, and soon forms in the boiled oil). Yield by cold process 16–20 p. c., by heat 25–28 p. c., the latter being darker, with stronger odor and more acid taste. *Tests:* 1. Linseed oil spread in thin layer on glass plate forms a hard, transparent film (abs. of non-drying oils). 2. Add 3 Gm. potassium hydroxide to oil 10 cc. + alcohol 10 cc. + distilled water 10 cc., heat on water-bath until clear; the addition of distilled water 100 cc.—clear solution, free from oily drops (abs. of mineral or rosin oils). 3. Oil 2 cc. + glacial acetic acid 2, agitate, cool, add sulphuric acid 1

drop—greenish color (abs. of rosin or rosin oils, which produce a violet color). *Impurities:* Free acid, non-drying oils, mineral or rosin oils, rosin. Should be kept in well-stoppered containers, and that which has been "boiled" must not be used or dispensed. Dose, ʒss–2 (15–60 cc.).

PREPARATIONS.—SEED: 1. *Species Emollientes, Emollient Cataplasm, N.F.*, 20 p. c. OIL: 1. *Sapo Mollis.* Soft Soap. (Syn., Sapo Moll., Sapo Viridis, Green Soap; Fr. Savon (mou) vert; Ger. Sapo kalinus, Kaliseife, Grune seife.)

Manufacture: Boil, stirring frequently, dekanormal solution of potassium hydroxide 29 cc. and sodium hydroxide 110 with linseed oil 400 and water q. s. 925, add glycerin 50 cc., boil until clear, add hot water q. s. 1000 Gm., let stand, stir until water absorbed. It is a soft, unctuous, yellowish-white mass, slight characteristic odor, alkaline taste; aqueous solution alkaline; solution in hot distilled water (1 in 20) nearly clear.

Preps.: 1. *Linimentum Saponis Mollis.* Liniment of Soft Soap. (Syn., Lin. Sapon. Moll., Tincture of Green Soap, Spiritus Saponis Kalinus Hebra; Fr. Teinture de Savon vert; Ger. Hebra's Seifenspiritus.)

Manufacture: 65 p. c. Mix oil of lavender 2 cc. with alcohol 30, add soft soap 65 Gm., stir or agitate until dissolved, set aside 24 hours, filter, add alcohol q. s. 100 cc.; used externally.

2. *Linimentum Saponis Mollis Compositum, Tinctura Saponis Viridis Composita, N.F.*, 15 p. c.—soft soap 15 Gm., oil of cade 2 cc., alcohol q. s. 100 cc.

2. *Linimentum Calcis*, 50 p. c. 3. *Liquor Cresolis Compositus*, 35 p. c. 4. *Ceratum Resinæ Compositum, Deshler's Salve, N.F.*, 13.5 p. c. 5. *Pasta Zinci Mollis, N.F.*, 25 p. c. 6. *Petroxolinum Sulphuratum, N.F.*, 37 p. c.

Unoff. Preps.: SEED. *Infusion*, 5 p. c. *Compound Infusion*, 5 p. c., + glycyrrhiza root 2 p. c. These were once official and are effective from the dissolved mucilage of the epithelium (testa), which is altered starch. Dose, *ad libitum*. *Decoction*, 5 p. c. *Poultice.*

PROPERTIES.—Demulcent, emollient, diluent, diuretic.

USES.—*Infusion* or tea for inflammation of mucous membranes of respiratory, digestive, and urinary organs, renal and vesical irritation, catarrh, dysentery, calculi, strangury. *Decoction*, owing to the oil it contains, is less acceptable to the mouth, but all the better for enema. *Poultice* of ground meal to enlarged glands, swellings, boils, pneumonia, etc., made by adding boiling water to meal for proper consistency and bringing to a boil. Should coat skin with glycerin, olive or other oil before applying, and place as near to affected spot as possible; may cover with oiled silk to retain heat and moisture, and may add olive oil, lard, laudanum or any anodyne, stimulating, or astringent solution to poultice. The oil is laxative (ʒj; 30 cc.), excellent in piles (ʒj–2; 30–60 cc. night and morning); sometimes it is added to purgative enemata, also to cover erysipelatous and irritated skin surfaces,

but with the disadvantages of soon drying (thus rendering skin stiff) and becoming sour and irritating. The *linimentum calcis* is applied to recent burns to allay irritation.

Allied Products:

1. *Flaxseed Cake, Oil-cake.*—Flaxseed when ground yields cake-meal, and this, after being deprived of oil, becomes oil-cake; it still contains all of the nitrogen, 4–5 p. c., and, moreover, a little oil, thus serving well as a cattle food; yields ash 5–8 p. c.

2. *Boiled Linseed Oil.*—Obtained by heating oleum lini to 130° C. (266° F.), while passing a current of air through it, when it boils, losing 6–8 p. c. by weight; or may heat and add litharge, red lead, manganese dioxide, lead acetate or manganous borate, thereby increasing the oil's weight and drying properties. It is darker in color, thicker, sp. gr. 0.939–0.950, and dries faster, hence useful in painting, varnishing, etc., but must never be used in liniments as a substitute for the official ("raw") oil, since irreparable injury (from forming crusts) might be occasioned to burns, etc., in removing dressings.

3. *Flax Liber-fibers.*—These furnish linen, which, when scraped, gives lint, while the primitive short fiber is useful as tow.

36. ERYTHROXYLACEÆ. Coca Family.

Er-i-throx-sil-a'se-e. L. *Erythroxyl-on* + aceæ, fr. Gr. ερυθρός, red, + ξύλον, wood—*i. e.*, some species have red wood. Shrubs, trees. Distinguished by flowers regular, small, calyx 5-lobed, petals 5, stamens 10, ovary 1–3-celled, superior; fruit drupe; temperate climates, tropics; stimulant, tonic, narcotic, dye.

Genus: **1. Erythroxylon.**

COCA. COCA.

Cocaina. Cocaine, *U.S.P.*

Erythroxylon Coca, *Lamarck,* and other species. } An alkaloid obtained from the leaves.

Habitat. Peru, Bolivia, Ecuador—eastern slopes of the Andes (Colombia, Brazil, India, Ceylon, Java); cultivated.

Syn. Erythroxylon, Spadic, Coca leaves, Cuca, Hayo, Ipado, Coca Folia; Fr. Feuilles de Coca; Ger. Kokablätter; Cocain, Methyl-benzoyl-ecgonine; Br. Cocaina; Fr. Cocaine; Ger. Cocainum, Kokaina.

Er-y-throx'y-lon. L. see Etymology, above, of Erythroxylaceæ.

Co'ca. Sp. from native name, meaning tree or plant, *par excellence.*

Plant.—Shrub 1–2 M. (3–6°) high, with many spreading, purplish, brown branches, wrinkled bark, smooth twigs; flowers small, yellow-petals 5; stamens 10; fruit reddish drupe, oval, 12 Mm. ($\frac{1}{2}'$) long, sarcocarp scanty. Leaves oval-elliptical, 2.5–7.5 Cm. (1–3′) long, 2–4

Cm. ($\frac{4}{5}$–$1\frac{3}{5}'$) broad, greenish-brown or clear brown, smooth, slightly glossy and coriaceous, shortly petioled, base short and abruptly narrowed, entire, midrib prominent underneath, with conspicuous line of collenchyma tissue running longitudinally on either side, one-third the distance between it and the margin, the enclosed areola of slightly different color; odor characteristic; taste bitterish, faintly aromatic, followed by numbness of tongue, lips, and fauces; powder yellowish-green. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—Leaves that are smudgy brown or with dull surface, also small jaborandi leaves, sometimes 40–50 p. c.; Inga and Pacay flowers by accident.

Fig. 211.—*Erythroxylon Coca.*

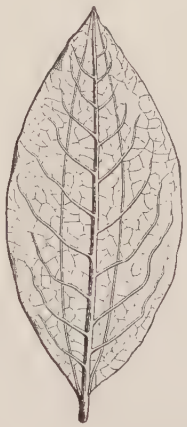


Fig. 212.—Coca leaf: under side, usual size.

Commercial.—Coca, although not introduced into England until 1870, was used in S. America prior to the Spanish conquest, 1569, by the aborigines, who extolled it as a God-given plant ("The Divine Plant of the Incas") that satisfied hunger, strengthened the weak, and banished man's misfortunes; but the invaders, intolerant of such homage, forbade its use and cultivation until they observed that it enabled the conquered to perform better work and service. Previous to 1884 the alleged properties were thought legendary and imaginative, when, being considered simply a mild stimulant like tea, Koeler proclaimed its local anesthetic power. Species differ when wild and under cultivation, and escaping this soon degenerate and show marked changes in leaf-characteristics. It is cultivated extensively in the Andes on terraced plantations, *cocales*, cleared from the forests on the warm declivities, thriving best in a moist atmosphere amid scattered trees,

but not deep shade, which, as well as low elevation, develops bitterness, consequently any variation in this or in the prescribed soil, exposure, and curing may affect quality. Propagation is similar to our peach,

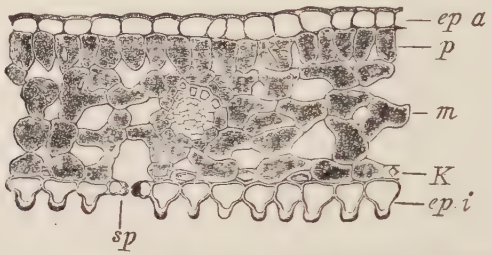


FIG. 213.—Coca leaf, cross-section; *ep a*, upper epidermis: *p*, palisade layer; *m*, spongy parenchyma (in the center a small fibro-vascular bundle); *K*, a crystal, magnified 160 diam.; *ep i*, epidermis of lower side with papilla and a stoma (*sp*).

yielding leaves the second year and continuing for fifty thereafter. Leaves when bright green above and yellow-green below are picked carefully to avoid breaking, or injuring young leaf-buds that form the next crop, removed in baskets, spread on unroofed floors, and dried quickly for a few hours in the sun, if too rapidly losing odor and green color, if too slowly acquiring disagreeable odor and taste; after remaining 2–3 days in the coca-house, in loose piles, they are exposed again for a short time to the sun, to drive off developed sweat, and then compressed into bales (*cestos*), 25–50 pounds; 11.6–23.3 Kg., or better, tin-lined boxes that prevent likely deterioration in shipping through fermentative decomposition. Irrespective of the care in drying and keeping impairment begins at once, cocaine decreasing materially, especially in dampness, owing to which they should be discarded after a few months. Although in some localities collection is almost continuous there are at least 2–3 yearly harvests, the September being best, the April next, each yielding when dried 60–80 pounds (27–37 Kg.) per acre; the annual production is about 80,000,000 pounds (37,383,177 Kg.), exported largely from Huanuco, Lima, Truxillo, etc. There are two varieties: 1, *Huanuco* (*Cuzco—E. Coca*, short-styled), after cities of S. Peru, has best aroma, most cocaine, and less isatropyl-cocaine; grown mostly in Bolivia, S. Peru, thriving and yielding maximum product at 1,050–1,800 M. (3,500–6,000°), in 18° south, and inferior grades at lower elevations; the true Bolivian (*E. bolivia'num*, long- styled) is prized most highly,

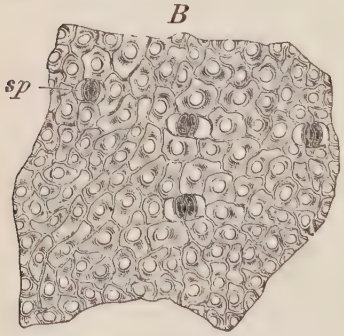


FIG. 214.—Coca leaf: Epidermis of lower side with the papillæ and stomata seen from above, magnified 160 diam.

has larger fruit, smaller leaves, and owing to home demand seldom is exported; 2, *Truxillo* (*Trujillo—E. truxillense*, short-styled), leaves ovate-oblanceolate, 1.6–5 Cm. ($\frac{2}{3}$–2′) long, one-half as broad, pale green, thin, brittle, usually much broken, smooth, shining, petiole short and stout, slight point at apex, entire, the two collenchyma lines underneath frequently incomplete or obscure; odor more tea-like than preceding; taste and numbing effect similar; powder pale green; grown more northward, thriving well at lower elevations and preferred by natives for chewing. Java and India coca (*E. Coca*, var. *Spruce'num*, long-styled, styles exceeding stamens) seems identical with this variety but owing to inferiority is not exported.

Constituents.—Cocaine (1860) .5–1 p. c., cinnamyl-cocaine, truxilline (truxil-cocaine, isatropyl-cocaine, cocamine), $C_{19}H_{23}O_4N$—all three upon hydrolysis yielding ecgonine and methyl alcohol; pseudotropine, ecgonine, coca-tannic acid, wax, volatile oil, ash 8–10 p. c.; hygrine (volatile aromatic liquid) is doubted by some, while cocainidine, probably isomeric with cocaine, but weaker, has not yet been studied thoroughly.

Cocaina. Cocaine, $C_{17}H_{21}O_4N$.—This alkaloid, composed of methyl alcohol, benzoic acid, and ecgonine, into which it separates by heating with strong sulphuric acid, is obtained by moistening leaves with sodium hydroxide solution, treating with benzin (kerosene), from which the alkaloids, as salts, can be transferred to diluted sulphuric acid by agitation; upon adding excess of sodium hydroxide solution the lesser alkaloids and cocaine are precipitated (hygrine, etc., remaining in solution); cocaine may now be separated by filtering and expressing, and purified by crystallizing from alcohol. It is in colorless crystals, white crystalline powder, odorless, permanent, soluble in water (600), hot water (270), alcohol (6.5), chloroform (.7), ether (3.5), olive oil (12), liquid petrolatum (30–50), very soluble in warm alcohol, melts at 97° C. (207° F.); forms salts (hydrochloride, nitrate, sulphate, etc.). Dose, gr. $\frac{1}{8}$–2 (.008–.13 Gm.).

Preparations.—1. *Cocainæ Hydrochloridum.* Cocaine Hydrochloride, $C_{17}H_{21}O_4N.HCl$. (Syn., Cocain. Hydrochl., Cocainum hydrochloricum, Cocaine Chloride, Cocainæ Hydrochloras, Cocaine Hydrochlorate; Fr. Chlorhydrate de Cocaïne; Ger. Cocainum hydrochloricum, Kokainhydrochlorid.)

Manufacture: Dissolve pure alkaloid, cocaine, in alcoholic solution of hydrochloric acid, and allow anhydrous salt to crystallize. It is in colorless, transparent crystals, lustrous leaflets, white, crystalline powder, permanent, odorless, soluble in water (.4), alcohol (3.2), warm alcohol (2), chloroform (12.5), glycerin, insoluble in ether; aqueous solution (1 in 20) neutral, levorotatory; melts at 183–191° C. (362–376° F.), the higher point indicating greater purity. *Tests:* 1. Aqueous solution (1 in 20) + silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Aqueous solution (1 in 50) 5 cc. + 5 drops of chromium

trioxide solution (1 in 20)—yellow precipitate, redissolved on shaking; now add hydrochloric acid 1 cc.—permanent orange crystalline precipitate. 3. Dissolve .5 Gm. in sulphuric acid 1 cc.—not more than slight yellow tint (abs. of readily carbonizable substances)—add cautiously distilled water 2 cc.—aromatic odor of methyl benzoate, on cooling—crystals of benzoic acid separate; incinerate .5 Gm.—ash negligible. 4. Aqueous solution (1 in 50) 5 cc. + $\frac{N}{1}$ sulphuric acid .3 cc. + $\frac{N}{10}$ potassium permanganate .1 cc.—violet color does not disappear entirely in half hour (abs. of cinnamyl-cocaine). *Impurities:* Cinnamyl-cocaine, isatropyl-cocaine, readily carbonizable substances. This salt is dispensed generally under the name of cocaine in (hypodermic) solutions, 2–4–5–10 p. c. Dose, gr. $\frac{1}{8}$–2 (.008–.13 Gm.).

Unoff. Preps.: I. Leaves: *Fluidextract* (diluted alcohol), ʒss–2 (2–8 cc.). *Infusion,* 5 p. c., ʒj–2 (30–60 cc.). *Tincture,* 20 p. c. (diluted alcohol), ʒj–4 (4–15 cc.). *Wine,* 6.5 p. c., ʒij–4 (8–15 cc.). II. Cocaine: *Oleate,* 5–10 p. c. *Unguentum Cocainæ* (Br.), 4 p. c. III. Cocaine Hydrochloride: *Injectio Cocainæ Hypodermica* (Br.), 5 p. c., ♏v–10 (.3–.6 cc.). *Lamellæ Cocainæ, Discs* (Br.), $\frac{1}{50}$ gr. (.0013 Gm.).

Properties.—Cerebral stimulant, bitter tonic, diuretic, mydriatic, diaphoretic, anaphrodisiac, narcotic. Locally, has little action upon the unbroken skin, but acts upon mucous membranes and subcutaneous tissue as anesthetic and analgesic, producing also its constitutional effects. It increases digestion, respiration, heart action, temperature, arterial tension, and the irritability of the sensory nerves, followed by mental, moral, and muscular depression. It anesthetizes the gastric mucous membrane, thereby temporarily deadening the sensations of hunger and thirst, which, however, seem all the greater as the effects wear off; the brain is stimulated by increasing the blood supply, producing wakefulness, a sense of hilarity and well-being (similar to cannabis), increased muscular strength and endurance. Acts as a diuretic by checking waste processes, lessening the quantity of urea, but increases that of urine; dilates the pupil by stimulating the ends of sympathetic nerve in the iris. When full amount (leaves) chewed one works cheerfully as long as the effect lasts, irrespective of meal hour, which may continue 3–4 days from repeated doses—usually, however, food is taken at night, and only the meal of mid-day bridged over. Natives drink its tea like Chinese tea elsewhere, and carry a bag of leaves and one of ashes or lime; after forming a quid of the leaves deprived of ribs (ʒj; 4 Gm.), a little ash or lime is added to give pungency and to aid the secretion of saliva; each chew lasts an hour, when a new one follows. Cocaine, in general action, resembles atropine; causes little injury to natives, but strangers soon become haggard-looking and idiotic.

Uses.—In melancholia, hysteria, epilepsy, spinal paralysis, insanity, diabetes, headache, typhoid state, opium-habit, uterine inertia, vomiting of pregnancy, gastric irritability, cholera morbus, spermator-

rhea, debility, poisoning by chloral hydrate, opium, or bromides. Locally, to burns, painful ulcers, fissures of anus, hay fever, sore throat, laryngitis, hemorrhoids, bronchitis, coryza, and in surgical operations; hypodermically in fingers, toes, small tumors—for amputation; for spinal anesthesia not as safe as novocaine, stovaine, eucaine; no more than gr. $\frac{3}{4}$ (.045 Gm.) should be applied at once.

Poisoning: Have nervous excitement, oppression, and fullness of head, sometimes nausea and vomiting, pulse and respiration at first rapid, then slow, breathing labored, face cyanotic, pupils dilated,

FIG. 215.—*Guaiacum sanctum.*

extremities cold, convulsions, coma, death; may have delirium and unconsciousness early, or only asphyxia. Place in horizontal position and fresh air, empty stomach, stimulants—strong coffee, etc., and if circulation fails—strychnine, ether, alcohol, amyl nitrite, caffeine, atropine, oxygen and ammonia inhalations; chloral hydrate (gr. 30–60; 2–4 Gm.), paraldehyde, sulphonal, chloroform, ether or morphine injections; artificial respiration; nitroglycerin (hypodermically) for convulsions. Chronic poisoning (*cocainism* or *habit*), marked by loss of flesh, disordered circulation, insane delusions and hallucinations, collapse, is more rapid and nearly as degenerative and serious as

that of opium, and may be treated similarly, but usage does not create nerve irritation to the same extent, consequently one with strong will power may desist abruptly its use without suffering other than the denial of mental satisfaction and pleasures, the craving for which it tends to establish.

Incompatibles: Alkalies, alkaline carbonates and bicarbonates, mercuric chloride, iodine, iodides, ammonia, zinc chloride, borax.

Synergists: Cerebral effects—alcohol, cannabis, belladonna; analgesic—atropine, phenol, conium, opium; mydriatic—atropine.

Allied Plants:

1. *Guai'acum officina'le* or *G. sanc'tum, Guaiac, Guaiac Resin, N.F.*—Zygophyllaceæ. The resin of the wood, yielding not more than 15 p. c. of residue insoluble in alcohol; W. Indies, S. America. Small trees 6–9 M. (20–30°) high, stem-bark ash-gray, striated, spotted; leaves paripinnate, yoked in pairs, evergreen; leaflets 2.5–4 Cm. (1–1⅗′) long; flowers large, blue; fruit 2–5-celled capsule; seeds black, red. Wood (Lignum Vitæ): sap yellowish, heart brownish, heavier than water, sp. gr. 1.30, hard, dense, tough, resinous, with heat—emitting balsamic odor; taste slightly acrid; in shop as raspings. Resin: in irregular fragments, large masses, tears, brown—greenish gray-brown on exposure; fracture with glassy luster, thin pieces translucent, reddish to yellowish-brown. Powder, grayish, becoming green on exposure; odor balsamic; taste slightly acrid; soluble in alcohol, ether, chloroform, creosote, solutions of alkalies, chloral hydrate T. S., sparingly in carbon disulphide, benzene; alcoholic solution with excess of chlorine water or tincture ferric chloride—blue, changing quickly to green; solvents: alcohol, acetone, chloroform; contains guaiaretic acid, guaiaconic acid (alpha-resin) 50–70 p. c., guaiac beta-resin 10 p. c., gum 4–9 p. c., guaiacic acid, guaiac-yellow, by dry distillation get guaiacol. Alterative, diaphoretic, expectorant, stimulant, antiseptic; rheumatism, gout, lumbago, syphilis, scrofula, amenorrhea, dysmenorrhea, diphtheria. Dose, gr. 5–30 (.3–2 Gm.); 1. *Tinctura Guaiaci*, 20 p. c. (alcohol), dose, ♏v–60 (.3–4 cc.); 2. *Tinctura Guaiaci Ammoniata*, 20 p. c. (sp. ammon. arom.), dose, ♏v–30 (.3–2 cc.): Prep.: 1. *Gargarisma Guaiaci Compositum*, 10 p. c. + tr. cinch. co. 10, honey 20, pot. chloras 4, + ; 3. *Tinctura Guaiaci Composita, Dewees' Tincture of Guaiac*, 12.5 p. c., + pot. carb. .6, pimenta 3.2 (diluted alcohol), dose, ♏v–60 (.3–4 cc.). Mixture (Br.), 2.5 p. c., ℥iv–8 (15–30 cc.). Lozenge (Br.), 3 gr. (.2 Gm.), Syrup. *G. angustifo'lium;* S. Texas, Mexico. Wood hard, heavy, splitting irregularly, yellowish-brown; sometimes substituted for the preceding.

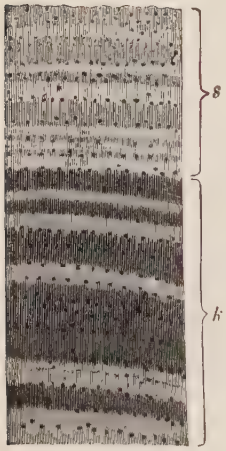


FIG. 216.—Guaiacum wood; cross-section, magnified 4 times; *k*, heartwood; *s*, sapwood.

37. RUTACEÆ. Rue Family.

Ru-ta'se-e. L. *Rut-a* + aceæ, fem. pl. of *rutaceus*, of or resembling rue, fr. Gr. *ῥυτή, ῥύω*, to flow—*i. e.*, referring to medicinal properties (female). Trees, herbs, shrubs. Distinguished by leaves exstipulate, dotted with pellucid glands, containing aromatic volatile oil; sepals 4–5; petals 4–5, imbricated; ovary connate or united by base, style, or stigma, superior; stamens distinct, equal or double the petals; albuminous or exalbuminous; tropics; antispasmodic, tonic, febrifuge, diuretic.

Genera: **1. Barosma. 2. Pilocarpus. 3. Citrus.**

BUCHU. BUCHU, *U.S.P.*

Barosma { **betulina,** (*Thunberg*) *Bartling et Wendland,* **crenulata,** (*Linné*) *Hooker,* **serratifolia,** (*Curtis*) *Willdenow.* } The dried leaf with not more than 8 p. c. stems nor 2 p. c. other foreign organic matter.

Habitat. S. Africa, Cape Colony (Cape of Good Hope, Cape Town); mountains.
Syn. Bookoo, Buku, Bucku, Bucco; Br. Buchu Folia, Folia Bucco, Diosmæ or Barosmæ; Fr. Feuilles de Bucco (Booko, Buchu); Ger. Bucco or Buchublätter.
Ba-ros'ma. L. fr. Gr. *βαρύς*, heavy + *ὀσμή* odor—*i. e.*, its powerful smell.
Be-tu-li'na. L. *betulinus*, fr. Celtic *betu*, their name for birch—*i. e.*, leaves resembling birch leaves.
Cren-u-la'ta. L. *crenulatus, crena*, notched, notch; *i. e.*, leaf margins crenulate.
Ser-ra-ti-fo'li-a. L. *serratus*, notched like a saw, + *folium*, a leaf—*i. e.*, leaves with margins saw-like, serrated.
Buchu (bu'ku). African plant name; *Diosma*, old name, meaning "divine odor."

Plants.—Woody shrubs, .3–1.2 M. (1–4°) high, branches many, stiff, angular, bark smooth, purple; young twigs covered with immersed oil-glands; flowers solitary, pink; calyx 5 segments, deeply cut; petals 5, glandular-punctate; stamens 5; fruit 5-coccus capsule, adherent by inner margins, 9 Mm. ($\frac{3}{8}'$) long, 12 Mm. ($\frac{1}{2}'$) broad, 5-seeded. Leaves, Leaf, (*B. betulina* + *B. crenulata: Short*, rhomboidally oval, obovate, 9–30 Mm. ($\frac{3}{8}$–$1\frac{1}{5}'$) long, 4–20 Mm. ($\frac{1}{6}$–$\frac{4}{5}'$) broad, apex obtuse, rounded, recurved, base wedge-shaped (cuneate), or obtuse, dentate, glandular-punctate, oil gland at the base of each tooth, papillose, longitudinally striate beneath, coriaceous, petiole 1 Mm. ($\frac{1}{25}'$) long, yellowish-green; odor aromatic, mint-like; taste camphoraceous; (*B. serratifolia*): *Long*, linear, lanceolate, 12–40 Mm. ($\frac{1}{2}$–$1\frac{3}{5}'$) long, 4–10 Mm. ($\frac{1}{6}$–$\frac{2}{5}'$) broad; apex acute, rounded, serrate, otherwise resembling the preceding. Powder, light green—epidermal cells with sphero-crystals, crystal aggregates of hesperidin, rosette aggregates of calcium oxalate, few simple hairs, numerous stomata, oil secretion cavities, oil globules, fragments of fibro-vascular bundles. *Solvents:* Alcohol; boiling water partially. Dose, gr. 15–30 (1–2 Gm.).

Adulterations.—Leaves, branchlets, flowers and non-aromatic capsules of allied species, also leaves of *Empleurum serrulatum*, which are yellowish-green, acute, different odor and taste, less mucilaginous

and contain volatile oil 1 p. c., without any crystalline content. *Karoo buchu* (*B. pulchel'la*), leaves 6 Mm. ($\frac{1}{4}'$) long, half as broad, thick, ovate, acute, nearly entire, apex recurved, oil gland not superficial; another variety (*Agathos'ma varia'bile*), leaves strong anise odor; *Psora'lea obli'qua*, leaves minutely dentate, hairy, brown dotted.

FIG. 217.—*Barosma crenulata:* 1, calyx; 2, style and stigma; 3, fruit; 4, seed; 5, dots on leaf.

Commercial.—Grows in stony, hilly valleys; cultivated in gardens, since 1774, for persistent attractive flowers. There are two varieties: 1, *Short* (*B. betulina*, *B. crenulata*), and 2, *Long* (*B. serratifolia*); the latter usually containing less of the active constituent—volatile oil .66 p. c., which is without diosphenol. Imported chiefly in large bales.

FIG. 218.—Buchu: *a*, *b*, *Barosma crenulata;* c, d. *B, betulina; g, h, B. serratifolia; e, f, Empleurum serrulatum; b, c, f, g, natural size.*

CONSTITUENTS.—Volatile oil 1–1.6 p. c., bitter glucoside (barosmin), hesperidin, resin, gum, salts, ash 4–7 p. c.

Volatile Oil, $C_{10}H_{16}O$.—This gives the medicinal properties, and is obtained by distillation and rectifying over sodium; sp. gr. 0.969; contains some $C_{10}H_{18}O$ (a body having peppermint-like odor), and upon cooling separates 30 p. c. barosma camphor, or phenol *diosphenol,*

$C_{10}H_{16}O_2$, a stearoptene occurring in white needle-like crystals, blackish-green with ferric salts.

Barosmin (*diosmin, rutin*).—Soluble in ether, volatile oils, dilute acids and alkalies, sparingly in alcohol, crystallizes in microscopic needles.

PREPARATIONS.—1. *Fluidextractum Buchu.* Fluidextract of Buchu. (Syn., Fldext. Buchu, Fluid Extract of Buchu; Fr. Extrait fluide de Bucco; Ger. Buchufluidextrakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126, menstruum: alcohol. Dose, ♏xv–30 (1–2 cc.).

Preps.: 1. *Elixir Buchu, N.F.*, 12.5 p. c.: Preps.: 1. *Elixir Buchu et Potassii Acetatis, N.F.*, 8.5 p. c. (pot. acet.). 2. *Elixir Buchu, Juniperi et Potassii Acetatis*, 15 p. c., + fldext. junip. 7.5, pot. acet. 5.

2. *Fluidextractum Buchu Compositum, N.F.*, 62.5 p. c., + cubeb, juniper berries, uva ursi, āā 12.5 (80 p. c. alcohol). Dose, ♏xv–30 (1–2 cc.): Prep.: 1. *Elixir Buchu Compositum, N.F.*, 25 p. c. + aromatic elixir q. s. 100. Dose, ℥j–2 (4–8 cc.).

Unoff. Preps.: Infusum Buchu (Br.), 5 p. c., ℥ss–2 (15–60 cc.). *Tinctura Buchu* (Br.), 20 p. c. (60 p. c. alcohol), ℥j–2 (4–8 cc.).

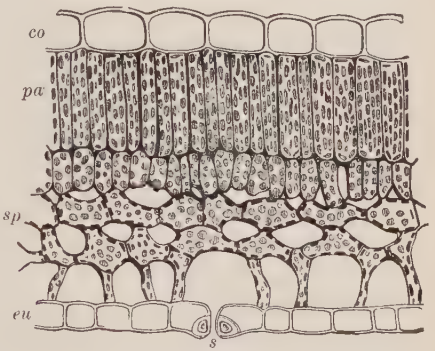


FIG. 219.—Buchu leaf: portion of a cross-section; *pa*, palisade cells; *sp*, spongy parenchyma; *co*, upper epidermis; *eu*, under epidermis; *s*, stomata.

PROPERTIES.—Diuretic, tonic, stimulant, carminative, diaphoretic; increases the fluids and solids of the urine, imparting peculiar odor; acts as a tonic, astringent, and disinfectant to the urinary tract, diminishing secretions. Large doses emetic, cathartic, causing burning in stomach, strangury; eliminated by the kidneys and bronchial mucous membrane.

USES.—Gravel, lithemia, vesical catarrh, irritated urethra, gonorrhea, gleet, chronic bronchitis, inflamed prostate, dropsy, retention or incontinence of urine, feeble digestion, flatulency; should not be given when inflammation is severe; often combined with alkalies, potassium hydroxide, etc. The native Hottentots, from whom the English and Dutch physicians learned its virtues, use an ointment as vulnerary, and a vinous tincture in gastric and vesical affections; they also value it as a perfume, rubbing the powdered leaves upon their greased bodies. *B. Ecklonia'na*, leaves oval, 2.5 Cm. (1′) long, rounded at base, crenate, growing from pubescent shoots, have similar properties.

Allied Plants:

1. *Zanthox'ylum america'num* and *Z. Cla'va-Her'culis.* 1. *Xanthoxylum, Prickly Ash Bark, N.F.*—The dried bark with not more than

RUTACEÆ

2 p. c. of foreign organic matter; 2. *Xanthoxyli Fructus, Prickly Ash Berry, N.F.* The dried fully grown fruit with not more than 2 p. c. of foreign organic matter; N. America; *Z. americanum*, Canada to Virginia—*Northern; Z. Clava-Herculis*, Virginia to Florida—*Southern. Z. americanum*, shrub 2–4 M. (6–12°) high, covered with sharp, scattered prickles; leaves imparipinnate, leaflets 4–5 pairs; flowers before the leaves, yellowish-green, corolla absent. Bark, transversely curved fragments, quills, 2–15 Cm. ($\frac{4}{5}$–6′) long, bark .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, light gray, with foliaceous lichens, wrinkled, whitish lenticels, few straight, 2-edged spines linear at base, 5 Mm. ($\frac{1}{5}$′) high, numerous shining crystals, fracture short, uneven, odor slight; taste bitter, acrid, pungent. Powder, light grayish-brown—parenchyma with starch grains, oily globules, calcium oxalate prisms; Northern—only a few

Fig. 220.—Xanthoxylum bark: *A*, Southern; *B*, Northern ($\frac{1}{3}$ Nat.).

non-lignified bast-fibers, stone cells and cork cell fragments; *Z. Clava-Herculis*, small tree, 6–12 M. (20–40°) high, .3–.6 M. (1–2°) thick, with prickles protruding through large corky cones, larger prickles on branches and petioles; leaflets 3–8 pairs, crenate; flowers after leaves appear, corolla present. Bark, transversely curved, irregular, oblong, flattened pieces, quills 2–40 Cm. ($\frac{4}{5}$–16′) long, bark 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, light gray, with numerous large barnacle-shaped projections of cork, .5–3.5 Cm. ($\frac{1}{5}$–1$\frac{2}{5}$′) thick, often 2 Cm. ($\frac{4}{5}$′) high, lenticels, foliaceous lichens, obscurely striate, without crystals; odor and taste as in preceding. Fruit, capsules with short stalks (*Z. americanum*) or without stalks (*Z. Clava-Herculis*), ellipsoidal, fleshy, gray-brown, dehiscent; seeds 1–2, oblong, black; odor faintly aromatic, citral-like; taste of two species quite different, but both pungent, warm, aromatic, tingling sensation on chewing. Powder, dark brown—pericarp tissue

with oil cavities, parenchyma cells with spherocrystals of hesperidin, numerous globules of volatile oil; solvents: alcohol, boiling water; contain (root and fruit) resins (2), alkaloid (bitter—berberine (?)), xanthoxylin (tasteless, inert, crystalline), volatile oil (acrid, green), tannin, sugar, fat, gum, ash 12 p. c. Alterative, stimulant, sialagogue, diaphoretic, diuretic—causes salivation, tingling in tongue, increased cardiac action and arterial tension, also secretion from stomach, intestines, liver, and pancreas; resembles mezereum, guaiac, sanguinaria and stillingia in action; chronic rheumatism, myalgia, lumbago, dropsies, atonic dyspepsia, diarrhea, syphilis, pharyngitis—masticatory for toothache, paralysis of tongue; externally: counter-irritant in female pelvic diseases. Dose, gr. 15–30 (1–2 Gm.); Root: 1. *Fluidextractum Xanthoxyli* (75 p. c. alcohol), dose, ♏xv–30 (1–2 cc.): Preps.: 1. *Elixir Corydalis Compositum,* 3 p. c.; 2. *Elixir Hydrastis Compositum,* 1.75 p. c. Decoction, 5 p. c., ℥ss–2 (15–60 cc.), Extract, gr. 3–10 (.2–.6 Gm.); Fruit (berry): 1. *Fluidextractum Stillingiæ Compositum,* 6.2 p. c.: Prep.: 1. *Syrupus Stillingiæ Compositus. Z. florid'anum, Satin Wood,* identical with *Z. carib'ænum; Z. ptero'ta,* Florida, Texas, Brazil—wood yellow, hard, bark and leaves pungent,

Fig. 221.—*Ruta graveolens.*

2. *Empleu'rum serrula'tum.*—Leaves sometimes mixed with buchu, occasionally constituting the main bulk; may be distinguished by their acrid taste, peculiar odor—differing from buchu—longer, narrower than even *B. serratifolia,* sides parallel, apex acute and glandless, coarsely dentate (serrulate); when held up to the light lateral veins not as straight, shorter and less strongly developed; contain peculiar volatile oil .64 p. c., possessing characteristic odor. Properties considered to differ from those of buchu.

3. *Ru'ta grave'olens.*—The leaves, U.S.P. 1830–1870; S. Europe, cultivated. Plant .6–1 M. (2–3°) high, woody; flowers yellow; fruit capsule, 4–5-lobed; seed black, many, all parts active; leaflets 12–25 Mm. (½–1′) long, 6 Mm. (¼′) wide, crenate, thick, pellucid-punctate, aromatic, bitter; contain volatile oil (Oleum Rutæ, U.S.P. 1870–1880, greenish-yellow, aromatic), rutin, (rutic or rutinic acid, $C_{42}H_{50}O_{25}$—bitter, yellow, crystalline glucoside, identical with barosmin, decomposing into quercetin, etc.). Stimulant, emmenagogue, nervine; hysteria, colic, amenorrhea, menorrhagia, metrorrhagia—due to atony of uterus; dangerous abortifacient; large doses irritant-poison—severe gastro-enteritis, vomiting, abdominal pain, distention, bloody stools, strangury, convulsions, rarely death. Dose, gr. 5–20 (.3–1.3 Gm.); oil, ♏j–5 (.06–.3 cc.).

RECAPITULATION TABLE No. 3—U. S. P. DRUGS AND PREPARATIONS.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Dose.
Rosaceæ:								
1. Rosa,	Rosa gallica.	The dried petals.	W. Asia.	Volatile oil, mucilage, tannin, quercitrin, sugar.	Fluidextract, mel., aq., aq. fort., ung.	Tonic, mild astringent, carminative.	Hemorrhages, aphthæ, ulcers, inflamed eyes, flavoring, perfumery.	Grains. 15–60 (1–4 Gm.).
Drupaceæ:								
1. Prunus Virginiana. 2. Wild Cherry.	Prunus serotina.	The stem bark.	N. America.	Amygdalin, emulsin, bit. prin., tannin, resin, gallic acid.	Syrup.	Sedative, pectoral, tonic, astringent.	Consumption, cough, scrofula, dyspepsia, debility, intermittents.	30–60 (2–4 Gm.).
1. Oleum Amygdalæ Amaræ. 2. Oil of Bitter Almond.	Amygdalus communis, var. amara.	The volatile oil.	W. Asia.	Benzaldehyde, hydrocyanic acid.	.....	Demulcent nutrient, sedative.	Coughs, pulmonary affections, flavoring.	Minims. ¼–1 (.016–.06 cc.).
1. Oleum Amygdalæ Expressum. 2. Expressed Oil of Almond.	Amygdalus communis, var. dulcis.	The fixed oil.	W. Asia.	Triolein, tripalmitin, trilinolein.	Ung. aq. rosæ.	Demulcent, nutritent.	Diabetes, confectionery.	ʒj–2 (30–60 cc.).
Mimosaceæ:								
1. Acacia. 2. Acacia.	Acacia Senegal, +.	The dried gummy exudation.	E. and W. Africa.	Arabic acid, combined with Ca, Mg, K, sugar.	Mucil., emuls., pulv. cretæ co., pills, troches.	Demulcent, emollient, nutritive.	Coughs, gastritis, dysentery, hemorrhages, typhoid, emulsifier, excipient.	Grains. ad lib.
Cæsalpinaceæ:								
1. Copaiba. 2. Copaiba.	Copaiba: One or more species.	The oleoresin.	Brazil.	Volatile oil, resin, bitter principle, copaivic acid.	.....	Diuretic, stimulant, expectorant, laxative.	Urinary affections, cystitis, bronchitis, hemorrhoids, dropsy, gonorrhea.	Minims. 10–60 (.6–4 cc.).
1. Senna. 2. Senna.	Cassia: Senna, angustifolia.	The dried leaflets.	E. and C. Africa, India.	Anthraglucosennin, emodin, chrysophan. acid, isoemodin, sennarhamnetin, sennanigrin.	Fluidextract, syr., pulv. glycyr. co.	Cathartic.	Constipation, hemorrhoids, fissures, fever.	Grains.[1] 30–180 (2–12 Gm.).
Krameriaceæ:								
1. Krameria. 2. Krameria.	Krameria: triandra, argentea.	The dried root.	Peru, Bolivia, Brazil.	Kramero-tannic acid, rhatanic acid, rhatanine.	Tincture.	Astringent, tonic.	Diarrhea, hemorrhage, gleet, sore throat, gums, eyes, nose.	5–30 (.3–2 Gm.).
Papilionaceæ:								
1. Tolu. 2. Tolu.	Toluifera Balsamum.	The balsam.	S. America.	Resin, volatile oil, cinnamic and benzoic acids, vanillin.	Syrup, tincture, tinct. benzoini comp., pills.	Stimulant, expectorant, vulnerary.	Bronchitis, catarrhs, coughs, flavor, perfumery.	5–30 (.3–2 Gm.).
1. Balsamum Peruvianum. 2. Balsam of Peru.	Toluifera Pereiræ.	The balsam.	C. America.	Cinnamein (vol. oil), resin, cinnamic, and benz. acids, vanillin.	.....	Stimulant, expectorant, vulnerary, stomachic.	Catarrhs, phthisis, gonorrhea, rheumatism, ulcers, eczema, scabies.	Minims. 5–30 (.3–2 cc.).

1. Tragacantha. 2. Tragacanth.	Astragalus gummifer, +.	The dried gummy exudation.	W. Asia.	Bassorin, calcium, compound of a gummic acid, starch.	Mucilage.	Demulcent, nutritious, expectorant.	Coughs, protective, excipient to pills and troches.	Grains. 5–30 (.3–2 Gm.).
1. Glycyrrhiza. 2. Glycyrrhiza (Licorice Root).	Glycyrrhiza glabra, var. typica, and glandulifera.	The dried rhizome and root.	S. Europe, W. Asia.	Glycyrrhizin, glycyramarin, asparagin, resin, starch, tannin.	Ext., tro. am. cl., fidext. cas. sag. ar., fidext., elix., mist. glyc. co., syr. sars. co., pulv. glyc. co., mass. hyd.	Demulcent, expectorant, laxative.	Catarrhs, bowel and urinary affections, coughs, colds.	15–60 (1–4 Gm.).
1. Santalum Rubrum. 2. Red Saunders.	Pterocarpus santalinus.	The heartwood.	S. Asia, Madras.	Santalin, santal, pterocarpin, homopterocarpin.	.....	Astringent.	Dyeing, for coloring tinctures, ointments, etc.	
1. Kino. 2. Kino.	Pterocarpus Marsupium.	The dried juice.	E. Indies.	Kino-tannic acid, kino-red, pyrocatechin, kinoin, gum.	Tincture.	Astringent, tonic, hemostatic.	Diarrhea, menorrhagia, leucorrhea, ulcers, sore throat.	5–20 (.3–1.3 Gm.).
1. Chrysarobinum. 2. Chrysarobin.	Vouacapoua Araroba.	A mixture of neutral principles.	Brazil.	$C_{30}H_{26}O_7$.	Ointment.	Irritant—externally.	Parasites, ringworm, psoriasis, eczema, hemorrhoids.	$\frac{1}{8}$ (.008 Gm.).
1. Physostigminæ Salicylas. 2. Physostigmine Salicylate.	Physostigma venenosum.	The alkaloidal salt from seed.	W. Africa.	$C_{15}H_{21}O_2N_3.C_7H_6O_3$.	.....	Sedative, myotic, poisonous, emetic, purg., diaphoretic.	Tetanus, paralysis, chorea, gastralg., convuls., strych. and atrop. poisoning.	$\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).
Linaceæ:								
1. Linum. 2. Linseed (Flaxseed).	Linum usitatissimum.	The dried ripe seed.	Levant, S. Europe (United States).	Fixed oil, mucilage, proteins, amygdalin, resin.	*Oil:* Soft soap, lin. s. s., lin. s. s. co.	Demulcent, emollient, diuretic.	Internal inflammations, catarrh, dysentery.	60–120 (4–8 Gm.).
1. Oleum Lini. 2. Linseed Oil.	.....	The fixed oil.	.....	Linolein, glycerides of palmitin, myristin, and olein.	Lin. cal., liq. cresol. co.	Demulcent, laxative.	Piles, erysipelas.	Minims. 240–960 (15–60 cc.).
Erythroxylaceæ:								Grains.
1. Cocaina. 2. Cocaine.	Erythroxylon Coca.	The alkaloid from leaves.	S. America (Peru, Bolivia).	LEAVES: Cocaine, hygrine, benzoylecgonine, cinnamylcocaine, truxilline, tannin.	Cocaine hydrochloride.	Stimulant, tonic, diaphoretic, narcotic, anesthetic.	Wasting diseases, convalesc., stomatitis, bronchi., surgery.	$\frac{1}{4}$–2 (.008–.13 Gm.).
Rutaceæ:								
2. Buchu. 2. Buchu.	Barosma: betulina, crenulata, serratifolia.	The dried leaves.	S. Africa.	Volatile oil, barosmin, diosphenol, resin.	Fluidextract.	Diuretic, stimulant, tonic, diaphoretic.	Urinary troubles, bladder catarrh, etc., feeble digestion.	15–30 (1–2 Gm.).

PILOCARPUS. PILOCARPUS.

Pilocarpinæ Hydrochloridum. Pilocarpine Hydrochloride, *U.S.P.*
Pilocarpinæ Nitras. Pilocarpine Nitrate, *U.S.P.*

Pilocarpus { **Jaborandi,** *Holmes,* / **microphyllus,** *Stapf.* } The hydrochloride and nitrate of pilocarpine, an alkaloid obtained from the dried leaflets.

Habitat. 1. Brazil—from Pernambuco; 2, Brazil—from Maranham; Paraguay, Uruguay; in forest-cleanings on the hill-slopes.

Syn. Pilocarp., Jaborandi, Pilocarpi Foliata; 1. Pernambuco Jaborandi. 2. Maranham Jaborandi; Fr. Jaborandi; Ger. Folia Jaborandi, Jaborandiblätter; Pilocarpin. Hydrochl., Pilocarpine Chloride, Pilocarpinæ Hydrochloras; Fr. Chlorhydrate de Pilocarpine; Ger. Pilocarpinum hydrochloricum, Pilokarpinhydrochlorid; Pilocarpin. Nit.; Fr. Azotate de Pilocarpine; Ger. Pilocarpinum nitricum, Pilokarpinnitrat.

Pi-lo-car'pus. L. *pilus,* hair, or fr. Gr. πῖλος a cap, + καρπός fruit—*i. e.,* fruit hat-shaped.

Jab-o-ran'di. L. fr. Port. *zha-bo-ran-de'*—*i. e.,* South American name.

Mi-cro-phyl'lus. L. fr. Gr. μικρός small, + φύλλον leaf—*i. e.,* having small leaves.

Plants.—Shrubs 1.2–1.5 M. (4–5°) high, branches erect; bark smooth, with gray and white dots, roots 18 Mm. ($\frac{3}{4}'$) thick; flowers small, pinkish-purple, pedicellate, racemes 45 Cm. (18′) long; fruit, 5 carpels 4 Cm. ($1\frac{3}{5}'$) long, compressed, curved ridges dotted with oil-glands, carpels 1-seeded, reniform, black; leaves imparipinnate, .3–.4 M. ($1–1\frac{1}{2}°$) long, 2–5 pairs. Leaflets (*P. Jaborandi*): *Pernambuco,* oval, oblong, elliptical, 4–10.5 Cm. ($1\frac{3}{5}–4'$) long, 2–4 Cm. ($\frac{4}{5}–1\frac{3}{5}'$) broad, short, stout petiolules, acute, emarginate (rounded), base rounded or acute, mostly unequal, entire, narrowly revolute, smooth, shiny, coriaceous, glandular-punctate, grayish-brownish-green above, midrib mostly depressed, yellowish-, greenish-brown beneath, slightly pubescent on the prominent midvein; peculiarly aromatic when crushed; taste bitterish, becoming pungent with sialagogue effect; (*P. microphyllus*): *Maranham,* rhomboidally oval, obovate, elliptical, 1.5–5 Cm. ($\frac{3}{5}–2'$) long, 1–3 Cm. ($\frac{2}{5}–1\frac{1}{5}'$) broad, lateral ones nearly sessile, terminal ones on margined petiolules, .5–1.5 Cm. ($\frac{1}{5}–\frac{3}{5}'$) long, nearly uniform grayish-, yellowish-green, rather thin, otherwise resembling the preceding. Powder, dark green-, greenish-brown—epidermal cells 5–6-sided, stomata usually with 4 neighboring cells, fragments of fibro-vascular bundles showing tracheæ, wood-fibers, bast-fibers, rosette aggregates of calcium oxalate, oil-secretion reservoirs with oil globules, non-glandular hairs; solvents: diluted alcohol; boiling water partially. Dose, gr. 15–30 (1–2 Gm.).

Adulterations.—Leaves from which pilocarpine has been extracted, or leaves of *Pilocarpus* species possessing little activity or of piperaceous plants (thin, subcoriaceous, ovate, not emarginate but acuminate, finely granular, not pellucid-punctate), or of *Monnie'ra trifo'lia* and *Casca'ria* species, or leaflets of *Swart'zia decip'iens* (ovoid, short hairy petiole, upper surface shining, lower minutely hairy, not pellucid-

punctate, some only 5 Mm. ($\frac{1}{5}$′) long) for "Maranham Jaborandi," sometimes 30 p. c., or "False Jaborandi"—leaves of *Hæmatoxylon campechianum*, notched apex, pellucid-punctate, without alkaloid, with red-brown secreting vessels, cinnamon and clove odor.

Commercial.—Plant was introduced into Europe, 1847, and now is cultivated. The names *Jaborandi, Jamborandi, Iaborandi* are applied natively, in both generic and specific sense, to several dissimilar pungent plants having sialagogic, diaphoretic and sudorific properties, as *Serro'nea Jaborandi, Piper Jaborandi* (possibly the true Jaborandi), *P. unguicula'tum, P. citrifo'lium, P. reticula'tum, P. Mollico'mum, Erte'la* (*Auble'tia*) *trifo'lia, Xanthoxylum el'egans.* Leaves should be

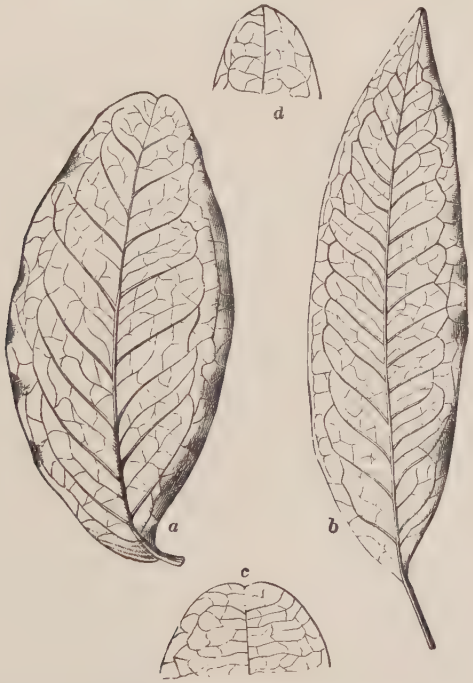


FIG. 222.—*Pilocarpus Jaborandi:* variously shaped leaflets. *a* and *c*, emarginate; *b* and *d*, pointed, blunt.

collected when grown, after rainy season, and, inclining to mustiness, should be dried thoroughly before packing. The once official species are high-priced, scarce, and subject to much substitution, while the Rio Jaborandi (*P. Selloanus*), also once official and popular, continues to have a limited demand in spite of great irregularity in characteristics and constituents.

CONSTITUENTS.—Pilocarpine .5–1 p. c. (1874), isopilocarpine, pilocarpidine, jaborine (?), volatile oil .5 p. c., (resin, tannin, malic acid, salts), ash 7 p. c.

RUTACEÆ

Pilocarpine (Pilocarpina), $C_{11}H_{16}O_2N_2$.—This liquid alkaloid, as first obtained under the name of jaborandine, was believed to be volatile, but this is not true, although it occurs as a colorless, syrupy liquid. It may be prepared by moistening powdered leaves with solution of sodium carbonate, exhausting with warm benzene, shaking out with diluted hydrochloric acid, after separation rendering acid solution alkaline with solution of sodium carbonate, shaking out with chloroform, evaporating chloroformic liquid getting residue of crude alkaloids; neutralize with diluted nitric acid, evaporate to dryness, purify by repeated crystallization from alcohol, dissolve pilocarpine nitrate in water, render alkaline with ammonia, shake out with chloroform, evaporate getting pure pilocarpine as a colorless syrupy liquid; it is soluble in water, alcohol, chloroform, slightly in ether, forms crystallizable salts (hydrochloride, nitrate, etc.); resembles nicotine in action.

Pilocarpinæ Hydrochloridum. Pilocarpine Hydrochloride, $C_{11}H_{16}O_2N_2$.HCl.—Obtained by neutralizing diluted hydrochloric acid (17.5) with pilocarpine (10), concentrating, setting aside over sulphuric acid to crystallize; it is in colorless, translucent crystals, odorless, faintly bitter taste, hygroscopic on exposure, soluble in water (.3), alcohol (3), hot alcohol (1.5), chloroform (366), insoluble in ether; aqueous solution (1 in 20) slightly acid, melts at 197° C. (387° F.). *Tests:* 1. To aqueous solution (.01–.02 in 2) add 2 cc. acid hydrogen dioxide T. S., cover with 1 cc. benzene, add 3–4 drops potassium dichromate solution (1 in 300), shake, benzene layer—violet, aqueous layer—yellow (dist. from other alkaloids). 2. Aqueous solution with silver nitrate T. S.—white precipitate, insoluble in nitric acid. 3. Solution of .1 Gm. in 2 cc. sulphuric acid—colorless or faintly yellow (abs. of readily carbonizable substances). 4. Add to 10 cc. aqueous solution (1 in 100) ammonia T. S., or potassium dichromate T. S.—no turbidity (abs. of foreign alkaloids); ash from .1 Gm.—negligible. *Impurities:* Foreign alkaloids, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

Pilocarpinæ Nitras. Pilocarpine Nitrate, $C_{11}H_{16}O_2N_2.HNO_3$.—Obtained by neutralizing diluted nitric acid (121) with pilocarpine (40), evaporating to dryness, redissolving in alcohol, crystallizing; it is in shining crystals, odorless, permanent, soluble in water (4), alcohol (75), hot alcohol (21), insoluble in chloroform, ether, melts at 172° C. (342° F.). *Tests:* 1. Aqueous solution mixed with equal volume of ferrous sulphate T. S. and carefully poured over sulphuric acid without shaking—brown ring at juncture of two layers. 2. To 5 cc. aqueous solution (1 in 50), acidulated with nitric acid, + few drops silver nitrate T. S.—no immediate opalescence (abs. of chloride); ash from .1 Gm.—negligible. *Impurities:* Chloride, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), administered best hypodermically (2 p. c. aqueous solution).

Isopilocarpine.—Obtained by action of heat or alkali on pilocarpine; it is a colorless, viscid oil, oxidizing into pilocarpic acid, $C_{11}H_{16}O_5N_2$, boiling at 261° C. (502° F.), distilling without decomposition, isomeric with pilocarpine; pilocarpidine, $C_{10}H_{14}O_2N_2$, found in *P. Jaborandi* but not in *P. microphyllus*, is a liquid body, differing from pilocarpine by auric chloride not precipitating aqueous solutions, in being weaker, deliquescent, oxidizing in air to syrupy jaboridine (possibly identical with jaborandine, $C_{10}H_{12}O_3N_2$; jaborine, $C_{22}H_{32}O_4N_4$, is of doubtful occurrence, although formerly believed to be in the leaves and to be formed by evaporating acid solutions of pilocarpine; as such it was yellow, amorphous, less soluble in water, but more so in ether than pilocarpine, isomeric with it (same molecular formula), but antagonizing its action, resembling atropine; the commercial jaborine has been found to be a brown oil composed of isopilocarpine, pilocarpidine, pilocarpine, and coloring matter.

Volatile Oil.—Obtained by distillation at 176° C. (350° F.), and is chiefly a terpene (pilocarpene) $C_{10}H_{16}$, with little solid paraffin-like substance, sp. gr. 0.875.

Preparations.—(Unoff.). Leaves: *Fluidextract* (67 p. c. alcohol), dose, ♏xv–30 (1–2 cc.). *Extract*, gr. 3–10 (.2–.6 Gm.). *Infusion*, ℥j–2 (30–60 cc.). *Tinctura Pilocarpi* (*Jaborandi*), 20 p. c., ℥ss–2 (2–8 cc.). Pilocarpine, phosphate, acetate, hydrobromide, dose, each gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), hypodermically.

Properties.—Diaphoretic, sialagogue, myotic, cardiac depressant, emetic, diuretic (repeated small doses), galactagogue, abortive. Full doses cause flushed face, quickened circulation and respiration, profuse sweating and salivation (lasting 2–4 hours, losing in perspiration 9–15 ounces (.27–.45 L.), in saliva 10–27 ounces (.3–.8 L.), these always being in the inverse ratio); increases bronchial, nasal, mammary, gastric, and intestinal secretions, lowers temperature 1–4 degrees, contracts pupils, produces chilliness and weakness. The heart soon becomes slowed and arterial pressure lowered, by stimulating the terminations of the vagus, or by depressing the motor centers in the heart-muscle. Both the fluid and solids (especially urea) of the perspiration are increased, by direct influence on the nerve-endings governing its secretion, while the cells of the salivary glands are stimulated directly. Pilocarpine produces identical effects of the drug; isopilocarpine is 8–10 times weaker than pilocarpine, while jaborine irritates the stomach, causing nausea, vomiting, etc.

Uses.—Dropsies, pleurisy, uremia, pulmonic edema, catarrhal jaundice, mumps, rheumatism, coryza, cold, influenza, Bright's disease, meningitis, diabetes, agalactia, parotitis, asthma, hiccough, erysipelas, diphtheria; best antidote to atropine, hyoscyamine, daturine, agaricin, etc.; powerful stimulant to hair growth—locally and internally. In ophthalmia use pilocarpine, in amblyopia (from alcohol or tobacco), detached retina, chronic iritis, keratitis, glaucoma, atrophic choroiditis,

instead of physostigmine as a myositic. To avoid nausea, may give in form of enema.

Poisoning: Have profuse sweating, dizziness, salivation, vomiting, purging, contracted pupils, pain in eyes. Empty the stomach and wash it out with tannin; give atropine hypodermically and morphine to control nausea and vomiting; cardiac stimulants if necessary.

Incompatibles: Atropine, agaricin, morphine, tannin, caustic alkalies, ferric and metallic salts.

Synergists: Aconite, veratrum viride, gelsemium, sarsaparilla, spirit of ethyl nitrite, and drugs which paralyze the vasomotor system. *P. Selloa'nus* (possibly the same as *P. pinnatifo'lius*, leaflets under both names formerly official); *P. grandiflo'rus, P. pauciflo'rus, P. heterophyl'lus, P. spica'tus, P. trachylo'phus*—all have similar medicinal value.

Allied Plants:

1. *Cuspa'ria Angostu'ra, (Galipe'a Cusparia (officina'lis)), Angustura (Bark); Cusparia Cortex, Cusparia Bark.*—The bark, U.S.P. 1820–1870; Northern South America. Tree 4.5–6 M. (15–20°) high, leaves with 3 leaflets, 15–25 Cm. (6–10′) long, 5–10 Cm. (2–4′) broad, spotted white, tobacco odor, flowers white; bark in flat, curved, or quilled pieces 2.5 Mm. ($\frac{1}{10}$′) thick, ochrey-gray, friable periderm, inside cinnamon-red, striæ of calcium oxalate, aromatic, bitter; contains volatile oil, resin, angusturin, 4 alkaloids. Used for diarrhea, dysentery, dyspepsia, typhoid, stimulant, febrifuge, large doses emetic; in infusion, tincture, extract. Dose, gr. 10–30 (.3–2 Gm.).

Fig. 223.—Angustura bark: one-half natural size.

False Angustura Bark (*Strychnos Nux-vomica*) has stone-cells, no striæ of calcium oxalate; is very bitter, not aromatic, contains strychnine, brucine.

2. *Pte'lea trifolia'ta, Wafer-ash, Hop-tree, Swamp-Dogwood, Wingseed, Shrubby Trefoil.*—Root-bark; N. America—N.Y.–Fla.–Texas; rocky places. Handsome shrub, 2.4–3.6 M. (8–12°) high, branches dark brown; leaves petiolate, light green, trifoliate; leaflets sessile, ovate, short-acuminate, crenulate, lateral ones inequilateral, terminal one cuneate at base, finely pellucid-punctate; root-bark one or more inches long, light brown, wrinkled, with thin epidermis, internally yellowish-white, darker by exposure, odor peculiar, aromatic, taste bitter, pungent, acrid; contains berberine (bitter, tonic), tannin, gallic acid, resin. Aromatic, tonic, stimulant, antiperiodic; dyspepsia, low fevers with gastro-intestinal irritation, typhoid conditions. Dose, gr. 15–30 (1–2 Gm.); infusion, ʒss–1 (15–30 cc.); fluidextract. Leaves and young shoots anthelmintic; fruit (samara) aromatic, bitter, good substitute for hop.

AURANTIUM. ORANGE.

Aurantii Amari Cortex. **Bitter Orange Peel,** *U.S.P.*
Oleum Aurantii Florum. **Oil of (Neroli) Orange Flowers,** *N.F.*

Citrus Aurantium, (var. **amara,**) *Linné.*

1. The dried rind of the unripe fruit.
2. The volatile oil distilled from the fresh flowers.

Habitat. N. India, cultivated near the Mediterranean Sea, Spain, W. Indies, Madeira, China, S. and S. W. United States, Florida, California, etc.

Syn. Aurant. Amar. Cort., Curaçao (Wild) Orange, Aurantii Pericarpium, Cortex Pomorum Aurantii; Br. Aurantii Cortex Recens, Aurantii Cortex Siccatus; Fr. Écorce (Zeste) d'Orange amère, Écorce de Bigarade; Ger. Cortex Aurantii Fructus, Pomeranzenschale.

Cit'rus. L. fr. Gr. *κίτριον*, after the town of Citron in Judea, where it formerly flourished.

Au-ran'ti-um. L. *aurum*, gold—*i. e.*, yellow color of fruit.

A-ma'ra. L. *amarus*, bitter—*i. e.*, the decided bitter taste of the fruit.

Orange. Eng. fr. Skr. *nagarange* through the Arab. *naranj*.

PLANT.—Small tree 3–4.6 M. (10–15°) high; stem branched; bark shining, smooth, greenish-brown; leaves 7.5–10 Cm. (3–4′) long, ovate, evergreen, faintly serrate, with oil-vesicles, fragrant, petioles 12–25 Mm. ($\frac{1}{2}$–1′) long; flowers May, 2.5 Cm. (1′) broad, white;

FIG. 224.—*Citrus Aurantium* (var. *amara*): *1*, the end of a flowering twig; *2*, flower, vertical section; *3*, longitudinal section of ovary; *4*, seed; *5*, longitudinal section of seed; *6*, diagram of flower.

fruit 5–10 Cm. (2–4′) in diameter, round, red or yellow, 9–11-celled, each several-seeded. RIND (zest), in thin, irregular bands (ribbons) or quarters, yellowish, greenish-brown, numerous minute pits and fine reticulate ridges; inner surface whitish, many slight conical projections, fine anastomosing lines formed by vascular bundles; fracture hard, short; odor fragrant, aromatic; taste aromatic, bitter. POWDER,

yellowish-gray, light brown—many parenchyma fragments with thick cell walls, tracheæ very small, calcium oxalate prisms; with potassium hydroxide T. S.—yellowish. *Solvents:* alcohol; water. Dose, gr. 15–30 (1–2 Gm.). Oil (flowers), a pale yellow, slightly fluorescent, neutral liquid, distinctive fragrant odor, similar to orange blossoms, and an aromatic, sweet then bitter taste; soluble in alcohol (1) with violet fluorescence, neutral reaction, in 80 p. c. alcohol (2), with excess—cloudy; sp. gr. 0.874, dextrorotatory. Should be kept cool, dark, in small, well-stoppered, amber-colored bottles.

Commercial.—This bitter fruit grows mostly in Spain, Madeira, India, China, being known as Seville or Bigarade Orange, and is not in the fresh state a commercial article with us. The Mandarin (*C. sinen'sis*), S. Europe, is much smaller, having flattened ends, very thin rind, and pleasant taste. The celebrated Bizarria, of Italy, pro-

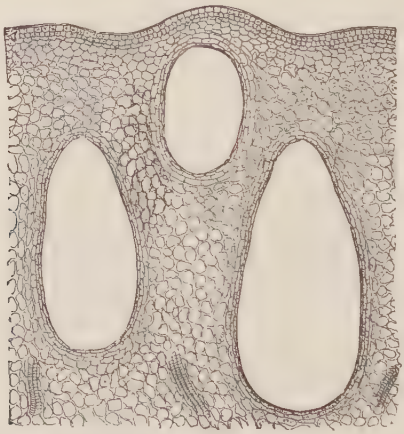


Fig. 225.—Orange peel: transverse section, magnified 65 diam.

duces on the same stem oranges, lemons, and citrons, and these often in mixed parts. The oil is distilled from fresh flowers, when it floats upon the water, and may easily be separated. There are four commercial grades: 1. *Ne'role* (*Essence de*) *Pe'tale*, most delicate—from flowers of *C. Aurantium*. 2. *Ne'role* (*Essence de*) *Bigarade*—from flowers of *C. amara* (*Bigaradia*), *N. F.* 3. *Ne'role* (*Essence de*) *Portugal*—from immature fruits of *C. Aurantium*, 4. *Ne'role* (*Essence de*) *Petit Grain*—from immature fruits and leaves of *C. amara*. Imported mostly from Grasse, Cannes, Messina, Nice.

Constituents.—Rind: Volatile oil, naringin (aurantiin) very bitter glucoside, aurantiamarin 1.5–2.5 p. c., leading bitter glucoside, isohesperidin .4–3 p. c., aurantiamaric acid .1 p. c., hesperidin, hesperic acid, (fixed oil, resin, gum, albumin, tannin, ash 4–7 p. c.). Oil (flowers): Limonene, linalool, linalyl acetate 7–18 p. c., geraniol, methyl anthranilate (to which odor and fluorescence are due).

Oleum Auranti Amari, *N.F.*—A volatile oil obtained by expression from the fresh peel. It is a pale yellow liquid, with characteristic, aromatic odor of Seville orange, and aromatic, bitter taste, soluble in alcohol (4), solution neutral, in all proportions of dehydrated alcohol, in glacial acetic acid (1); sp. gr. 0.845, dextrorotatory. Should be kept cool, dark, in small, well-stoppered, amber-colored bottles.

PREPARATIONS.—I. RIND: 1. *Tinctura Aurantii Amari.* Tincture of Bitter Orange Peel. (Syn., Tr. Aurant. Amar.; Br. Tinctura Aurantii; Fr. Teinture d'Écorce d'Oranges amères; Ger. Pomeranzen-(schalen)tinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104, menstruum: 60 p. c. alcohol. Dose, ℥j–2 (4–8 cc.).

Prep.: 1. *Elixir Aurantii Amari, N.F.,* 2 p. c.

2. *Tinctura Cinchonæ Composita,* 8 p. c. 3. *Tinctura Gentianæ Composita,* 4 p. c. 4. *Infusum Gentianæ Compositum, N.F.,* $\frac{4}{5}$ p. c. 5. *Tinctura Amara, N.F.,* 6 p. c.

II. FLOWERS: 1. *Aqua Aurantii Florum.* Orange Flower Water. (Syn., Aq. Aurant. Flor., Aqua Aurantii Florum Fortior, Triple Orange Flower Water.)

Manufacture: Obtained as a by-product in distilling oil of orange flowers, or by collecting 3 parts of distillate from 2 of flowers. It is a saturated solution of the odoriferous principles of the fresh flowers obtained by distilling with water and separating the clear, saturated portion of the distillate; it is nearly colorless, clear or faintly opalescent, strong pleasant odor, and taste of orange blossoms; must be free from empyreuma, mustiness, or fungoid growths, and is best preserved by allowing a limited access of fresh air to the container. *Tests:* 1. Evaporate 100 cc.—residue .001 Gm.; neutral, slightly acid. 2. With hydrogen sulphide T. S., or sodium sulphide T. S.—no reaction (abs. of metallic impurities). Dose, ℥j–4 (4–15 cc.).

Preps.: 1. *Syrupus Aurantii Florum.* Syrup of Orange Flowers. (Syn., Syr. Aurant. Flor.; Fr. Sirop de Fleurs d'Oranges; Ger. Pomeranzenblüthensirup.)

Manufacture: Dissolve by agitation sucrose 85 Gm. in a mixture of orange flower water and distilled water, each 22.5 cc., without heat, add of the latter q. s. 100 cc., mix thoroughly, strain. Dose, *ad libitum;* as a flavoring vehicle.

2. *Trochisci Acidi Tannici,* q. s. 3. *Elixir Aurantii Amari, N.F.,* 2 p. c. 4. *Elixir Amygdalæ Compositum, N.F.,* 15 p. c. 5. *Elixir Glycyrrhizæ Aquosum, N.F.,* 20 p. c. 6. *Liquor Hypophosphitum Compositus, N.F.,* 3.5 p. c. 7. *Liquor Phosphatum Compositus, N.F.,* 12.5 p. c. 8. *Syr. Calc. Lactophos., N.F.,* 5 p. c.

III. OIL (Rind): 1. *Elixir Aurantii Amari, N.F.,* $\frac{2}{5}$ p. c.

IV. OIL (Flowers): 1. *Spiritus Odoratus, N.F.,* $\frac{2}{5}$ p. c.

Unoff. Preps.: RIND: *Fldext.* (75 p. c. alc.). *Inf.* (Br.), 5 p. c., ℥iv–8 (15–30 cc.). *Inf. Comp.* (Br.), 2.5 p. c. + lemon peel 1, clove .5. *Wine* (Br.)—fermenting saccharine solution + fresh bitter orange peel.

PROPERTIES.—Stimulant, tonic, carminative, stomachic, bitter; excessive doses of both peel and oil cause colic, convulsions, occasionally death.

USES.—In indigestion, flatulence, corrigent to purgatives; aromatic when in combination with gentian, calumba, quassia, cinchona, etc.; most of the preparations are used as flavoring agents. Workmen employed among the fruit have skin eruptions, nervousness, headache, gastralgia, insomnia, muscular spasms.

AURANTII DULCIS CORTEX. SWEET ORANGE PEEL, *U.S.P.*

Citrus Aurantium, var. **sinensis,** *Linné.* { The fresh, outer rind of the ripe fruit.

Habitat. Same as *C. Aurantium* (var. *amara*).

Syn. Aurant. Dulc. Cort., Curaçao, Navel (Seedless) Orange, Forbidden Fruit, Golden (Orange) Apple, Nerotia Flowers; Fr. Écorce (Zeste) d'Orange douce; Ger. Apfelsinenchalen.

Si-nen'sis. L. (Chinensis) Chinese, of or belonging to China—*i. e.*, its chief habitat.

PLANT.—Small tree, 4.5–6 M. (15–20°) high, identical with *C. Aurantium* (var. *amara*), differing only in point of variety, but having leaves and flowers more fragrant, and the fruit sweeter, larger, deeper yellow. RIND (zest), the outer orange-yellow layer recently separated by grating or paring, consisting of epidermal cells, parenchyma cells

FIG. 226.—*Citrus Aurantium*, var. *sinensis*.

of sarcocarp with chromoplastids, oil reservoirs and globules of volatile oil; odor highly fragrant; taste pungently aromatic. *Solvents:* alcohol; water. Dose, gr. 15–30 (1–2 Gm.).

Commercial.—This sweet fruit grows only by cultivation; was unknown to the Greeks and Romans, being introduced first into Europe

by the Portuguese in the 15th century. There are now some fifty varieties cultivated in Spain, Portugal, Madeira, Azores, China, West Indies, S. and S. W. United States, many of which have been given commercial names after the districts of production, as China, Portugal, Havana, Florida, California, Messina, and Malta (blood-red). These are imported in boxes of 100–200, having each orange wrapped in tissue-paper, the sweetest coming to us from Havana, Florida, and California.

CONSTITUENTS.—Volatile oil, hesperidin, (fixed oil, resin, gum, tannin, ash 4–5 p. c.).

Oleum Aurantii. Oil of Orange, *U.S.P.*—(Syn., Ol. Aurant., Oleum Aurantii Corticis, U.S.P. 1900, Orange Oil, Oil of Sweet Orange, Oleum Aurantiorum, Essence (Essential Oil) of Orange; Fr. Huile d'Orange; Ger. Pomeranzenschalenöl.) This volatile oil is produced mostly in S. Italy, Sicily, by expression from the fresh peel of the ripe fruit (sweet orange and its varieties), or rupturing the oil-glands mechanically and collecting the liberated oil, as with oil of lemon; if obtained by distillation the product is decidedly less fragrant. It is a yellow liquid, characteristic odor and taste of the outer part of sweet orange peel, sp. gr. 0.844; soluble in dehydrated alcohol, carbon disulphide, glacial acetic acid (1); neutral reaction, dextrorotatory; contains limonene (citrene, hesperidene), $C_{10}H_{16}$, 90 p. c., odor bearers (citral, citronellal, methyl ester of anthranilic acid). *Tests:* 1. With 90 p. c. alcohol (2)—does not form clear solution (dif. from washed citrus oils). 2. Evaporate 25 Gm. to dryness—residue not less than 2 p. c. (dif. from washed citrus oils). 3. Should not have a terebinthinate odor or taste (abs. of oil of turpentine); must meet requirements for heavy metals. The oil from the peel of bitter orange (*N. F.*) though chemically indistinguishable, has a superior flavor, but a limited production, and usually is mixed with this oil (sweet orange). Oil having a terebinthinate odor must not be dispensed. Should be kept cool, dark, in small, well-stoppered, completely filled, amber-colored bottles (to avoid developing terebinthinate odor). Usually shipped in tinned-copper cans. Dose, ♏j–5 (.06–.3 cc.).

ADULTERATIONS.—Oil of turpentine, alcohol, etc.

PREPARATIONS.—I. RIND: 1. *Tinctura Aurantii Dulcis.* Tincture of Sweet Orange Peel. (Syn., Tr. Aurant. Dulc.; Fr. Teinture d'Orange douce; Ger. Apfelsinenschalentinktur.)

Manufacture: 50 p. c. Similar to Tinctura Cardamomi Composita, page 137—macerating 50 Gm. in alcohol 100 cc., filtering through purified cotton, and finishing with alcohol q. s. 100 cc. Dose, ʒj–2 (4–8 cc.); as a flavoring vehicle.

Preps.: 1. *Syrupus Aurantii.* Syrup of Orange. (Syn., Syr. Aurant., Syrupus Aurantii Corticis, Syrup of Orange Peel; Fr. Sirop d'Écorce d'Orange; Ger. Pomeranzen(Orangen-schalen)-sirup.)

Manufacture: Triturate purified talc 1.5 Gm. with tincture of sweet orange peel 5 cc. and citric acid .5 Gm., and add gradually distilled water 40 cc., filter, add through filter distilled water q. s. 45 cc.; dissolve in this, by agitation, sucrose 82 Gm. (without heat), add distilled water q. s. 100 cc., mix thoroughly, strain; must not dispense when of terebinthinate odor or taste or shows other deterioration. Dose, *ad libitum*—flavoring.

2. *Elixir Gentianæ Glycerinatum, N.F.*, 1.5 p. c. 3. *Elixir Pepsini et Rennini Compositum, N.F.*, 5 p. c. 4. *Elixir Taraxaci Compositum, N.F.*, 6 p. c. 5. *Elixir Terpini Hydratis, N.F.*, 2 p. c.

II. Oil: 1. *Spiritus Aurantii Compositus.* Compound Spirit of Orange. (Syn., Sp. Aurant. Co.; Fr. Esprit d'Orange composée; Ger. Zusammengesetzter Orangengeist.)

Manufacture: 20 p. c. Dissolve oil 20 cc., + oil of lemon 5, oil of coriander 2, oil of anise .5 in alcohol q. s. 100 cc. Should be kept in dark amber-colored bottles. As a flavoring vehicle.

Preps.: 1. *Elixir Aromaticum.* Aromatic Elixir. (Syn., Elix. Arom., Simple Elixir; Fr. Elixir aromatique; Ger. Aromatisches Elixir.)

Manufacture: $1\frac{1}{5}$ p. c. To compound spirit of orange 1.2 cc., add alcohol q. s. 25, to this add syrup 37.5, in several portions with agitation, distilled water 37.5, purified talc 3 Gm., filter until clear, wash filter with 25 p. c. alcohol q. s. 100 cc.—flavoring.

Preps.: 1. *Elixir Glycyrrhizæ*, 87.5 p. c. 2. *Numerous Elixirs*—as a vehicle.

2. *Elixir Aletridis Compositum, N.F.*, 1 p. c., + 10 other *N.F. Elixirs*—flavoring. 3. *Emulsa*—flavoring.

2. *Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, N.F.*, $\frac{1}{1\,5}$ p. c. 3. *Elixir Pepsini Compositum, N.F.*, $\frac{1}{5}$ p. c. 4. *Liquor Ferri Peptonati, N.F.*, $\frac{1}{6\,6}$ p. c. 5. *Liquor Ferri Peptonati et Mangani, N.F.*, $\frac{1}{6\,6}$ p. c. 6. *Spiritus Cardamomi Compositus, N.F.*, 2 p. c. 7. *Spiritus Myrciæ, N.F.*, $\frac{1}{2\,0}$ p. c. 8. *Spiritus Vanillini Compositus, N.F.*, 5 p. c. 9. *Syrupus Quinidinæ, N.F.*, $\frac{1}{5\,0}$ p. c. 10. *Tabellæ Sulphuris et Potassii Bitartratis, N.F.*, $\frac{1}{2\,0}$ ℳ. (.003 cc.). 11. *Trochisci Eucalypti Gummi, N.F.*, $\frac{1}{2\,0}$ ℳ. (.003 cc.).

Properties and Uses.—Aromatic; chiefly for flavoring and in perfumery; fruit deliciously edible.

LIMONIS CORTEX. LEMON PEEL, *U.S.P.*

Citrus medica, var. **Limonum**, (*Risso*) *Hooker filius.* { The outer yellow rind of the fresh ripe fruit.

Habitat. N. India; cultivated in subtropics, Mediterranean Basin, United States (California, Florida), Australia, etc.

Syn. Limon. Cort.; Fr. Écorce (Zest) de Citron (Limon); Citron, Limon; Ger. Cortex Fructus Citri, Flavido Corticis Citri, Citronen Limonen)-schale; Limone, Citrone.

Med'i-ca. L. *medicus*, medical, curative—*i. e.*, properties useful in medicine.
Li-mon'um. L. a lemon, fr. Arab. *limun, limu*, taken from Skr. *nimbuka.*

PLANT.—Straggling bush or tree, 3–4.5 M. (10–15°) high, more tender than the orange, having many angular branches and sharp spines in the leaf-axils; bark gray, that of branches green, of twigs reddish or purple; leaves evergreen, 5–6 Cm. (2–2⅖′) long, ovate, acute, serrate, 12 Mm. (½′) petioles; flowers all the year round, sweet-scented, white to purplish-pink; fruit ovoid berry 7.5 Cm. (3′) long with nipple-shaped extremity, smooth, depressed punctations over the oil-glands, structure like orange; pulp acid, yellow; seed as in orange, only smaller. PEEL, the outer, lemon-yellow, dark yellow layer, recently separated by grating, paring, and consisting of an epidermal layer, numerous parenchyma cells containing yellow chromoplastids, and large oil reservoirs with globules of the volatile oil; odor fragrant,

FIG. 227.—*Citrus medica*, var. *Limonum*: *a*, flower; *b*, fruit.

distinctive; taste aromatic; sections mounted in a fixed oil show epidermal layer (small tabular cells), hypodermal layer containing numerous plastids, a mesocarp with colorless, thin-walled parenchyma, large elliptical oil reservoirs, granular protoplasm, calcium oxalate crystals. The inner spongy white portion should be removed and discarded. *Solvents:* alcohol; wine; water. Dose, ʒss–1 (2–4 Gm.).

Commercial.—Lemons reach us from California, Florida, W. Indies, Mediterranean region (Sicily, Spain, etc.) packed in boxes, each lemon being wrapped in white or brownish tissue-paper. Foreign varieties are known as *wax*, *imperial*, *gœta*, and all, when kept several months, deteriorate, owing to the decomposition of citric acid, into sugar and carbon dioxide, in consequence of which, to insure preservation and permit long shipments, they must be coated with melted paraffin,

dissolved shellac, or varnish. The rind should be pared thinly from the fruit with sharp knives and carefully dried.

Constituents.—Volatile oil, bitter principle, hesperidin, ash 4 p. c.

Oleum Limonis. Oil of Lemon, *U.S.P.*—(Syn., Ol. Limon., Lemon Oil, Oleum de Cedro; Fr. Essence (Huile) de Citron—Cédrat; Ger. Citronöl, Limonenöl.) This volatile oil is produced mostly in Sicily, S. France, Italy (Calabria), by expression from fresh peel of the ripe fruit, using several processes that rupture mechanically the oil-cells thereby liberating the oil and rendering it easily collected: 1, *spugna*—collecting by sponge the oil from ruptured cells of the quartered rind; 2, *scorzetta*—of the halved rind; 3, *machina*—substituting a complicated machine for manual labor of expression and collection; 4, *écuelle à piquer*—not much used but consisting of an instrument, bowl-shaped, 25 Cm. (10′) wide, of tinned-copper, having a raised opening in the center which forms with the outer edge a broad channel; to this there is a heavy cover similarly shaped, whose inner surface as well as that of the machine is armed with concentric rows of short 6 Mm. ($\frac{1}{4}$′) spikes or ridges; an opening in the bottom allows the escape of oil. By a handle the cover is made to revolve rapidly one-half minute over the instrument, having between the two 5 to 8 fruits, after which they are replaced by fresh ones. About 7000 fruits can be exhausted daily by each machine. It is a pale yellow, greenish-yellow liquid, characteristic odor and taste of the outer part of fresh lemon peel, sp. gr. 0.853, dextrorotatory, soluble in alcohol (3), dehydrated alcohol, carbon disulphide, glacial acetic acid; neutral, slightly acid; contains at least 4 p. c. (7–8) of aldehydes calculated as citral, $C_{10}H_{16}O$, which gives the aroma and value (being also produced by oxidizing geraniol, $C_{10}H_{18}O$, with chromic acid), limonene (citrene), $C_{10}H_{16}$, 76 p. c., little cymene, $C_{10}H_{14}$, citronellal, $C_{10}H_{18}O$, phellandrene, pinene, geranyl acetate, a sesquiterpene, octyl aldehyde, nonyl aldehyde, methyl heptenone, terpineol. Should be kept cool, dark, in completely filled, well-stoppered, amber-colored bottles, and that having a terebinthinate odor must not be dispensed. Dose, ♏j–5 (.06–.3 cc.).

Adulterations.—Oils of other *Citrus* fruits, fixed oils, alcohol, oil of turpentine. The fragrant *Oil of Petit Grain Citronnier*, from immature fruits, leaves, and twigs, closely resembles *Neroli Petit Grain*, and may be used similarly.

Hesperidin, $C_{22}H_{26}O_{12}$.—A glucoside (bitter principle) from the white, spongy part or rind by boiling water; bitter, yellowish-white powder or white needles; soluble in diluted alkalies or acetic acid, black with ferric salts, and by diluted sulphuric acid decomposed into hesperetin, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$.

Preparations.—I. Peel: 1. *Tinctura Limonis.* Tincture of Lemon. (Syn., Tr. Limon., Tinctura Limonis Corticis; Fr. Teinture d'Écorce de Citron; Ger. Citronenschalentinktur.)

Manufacture: 50 p. c. Similar to Tinctura Cardamomi Composita, p. 137—macerating 50 Gm. in alcohol 100 cc., filtering through purified

cotton, and finishing with alcohol q. s. 100 cc. Dose, ʒss–2 (2–8 cc.).

Preps.: 1. *Syrupus Acidi Citrici*, 1 p. c. 2. *Emulsum Petrolati, N.F.*, 1.5 p. c.

II. Oil: *Liquor Magnesii Citratis*, $\frac{1}{10}$ cc. in 350. 2. *Spiritus Ammoniæ Aromaticus*, 1 p. c. 3. *Spiritus Aurantii Compositus*, 5 p. c. 4. *Acetum Aromaticum, N.F.*, $\frac{1}{10}$ p. c. 5. *Linimentum Terebinthinæ Aceticum, N.F.*, 1.6 p. c. 6. *Mistura Oleo-Balsamica, N.F.*, $\frac{2}{5}$ p. c. 7. *Spiritus Odoratus, N.F.*, $\frac{4}{5}$ p. c. 8. *Syrupus Eriodictyi Aromaticus, N.F.*, $\frac{1}{20}$ p. c. 9. *Syrupus Sennæ Aromaticus, N.F.*, $\frac{1}{7}$ p. c.

Unoff. Preps.: Peel: *Spirit*, 5 p. c., + oil 5 p. c. (alcohol), ʒss–2 (2–8 cc.). *Infusion. Syrup. Juice* (from fruit—used alone, neutralized by alkali, or made into syrup; soon spoils, but will keep a short time by letting stand until albumin is coagulated, straining into hot bottles, and covering with almond or sweet oil; flavor is preserved best by making it into concentrated syrup); yield $\frac{1}{2}$–1 ounce (15–30 cc.) per lemon, dose, ʒij–5 (8–20 cc.).

Properties and Uses.—Stimulant, stomachic, added usually to infusions, tinctures, etc., chiefly for flavoring. Juice refrigerant, relieves thirst, febrile inflammatory affections in agreeable beverages; diaphoretic (neutral mixture), scurvy (seamen on long voyages should take ʒj (30 cc.) daily as a preventive), acute rheumatism; locally in sunburn, pruritus of scrotum, uterine hemorrhage after labor, gargle in diphtheria.

Limones, Lemons. The fruit, U.S.P. 1820–1850. *Limonis Succus, Lemon Juice*, U.S.P. 1860–1900.

Allied Plants:

1. *Citrus Aurantium*, var. *Bergam'ia, Bergamot; Oleum Bergamottæ, Oil of Bergamot, N.F.*—The volatile oil obtained by expression from the rind of the fresh fruit with not less than 36 p. c. of ester, calculated as linalyl acetate; S. Italy, France; cultivated. Small tree resembling the lemon and orange, flowers peculiar, delicious odor, fruit pale lemon color, pyriform or globose, with concave receptacles of oil in the rind. Oil obtained as that of lemon and orange, and is a greenish-yellow liquid, neutral, faintly acid, characteristic fragrant odor, aromatic bitter taste; forms clear solution with alcohol ($\frac{1}{2}$), not turbid with further addition, soluble in glacial acetic acid, 80 p. c. alcohol (2), with slight cloudiness and no separation of oil globules; sp. gr. 0.877, dextrorotatory; 2 Gm. evaporated to soft green residue—corresponds to not more than 6 p. c. of the oil (abs. of fixed oils); contains limonene (citrene), dipentene (bergaptene, bergamot camphor), linalool, and linalool acetate 36–39 p. c., upon which the value chiefly depends. Stimulant, excitant, aromatic; used exclusively as a perfume; 1. *Spiritus Odoratus*, 1.5 p. c.

2. *C. med'ica, Citron.*—Small tree, but fruit very large, 20–22.5 Cm. (8–9′) long, resembling pineapple in shape. The rind is popular as a dessert, essence in perfumery, and juice for similar purposes as that of lemon and lime fruits. *C. medica*, var. *acida. Succus Citri*,

SIMARUBACEÆ

Lime Juice; contains citric acid 5–10 p. c. *Succus Citri et Pepsinum,* lime juice 60 p. c., + glycerite of pepsin 40.

3. *Æ'gle Mar'melos, Belæ Fructus, Bael Fruit* (Br.), *Bengal Quince.*—The fresh half-ripe fruit; Malabar, Coromandel, cultivated in India. Fruit round, size of a large orange, cherry-red color, aromatic, sweetish, acidulous, mucilaginous, astringent when unripe, laxative when ripe, seed woolly, pulp firm, brittle, 12-celled, covered with hard, gourd-like nearly smooth rind, 3 Mm. ($\frac{1}{8}$′) thick. The dried, half-ripe fruit is used, being adulterated sometimes with fruit of *Garcin'ia Mangosta'na, Mangosteen;* contains gum, pectin, sugar, tannin, bitter principle, volatile oil. It is mildly astringent. Dose, gr. 15–30 (1–2 Gm.), in diarrhea, dysentery.

38. SIMARUBACEÆ. Quassia Family.

Sim-a-ru-ba'se-e. L. *Simarub-a* + aceæ; from native name in Guiana. Shrubs, trees. Distinguished by containing bitter principle, and from allied Rutaceæ, by leaves being exstipulate, without glands or dots, alternate; ovary stalked, 4–5-lobed, superior; ovules 1 in each cell; stamens 8–10, augmented each by 1 or more scales; calyx 4–5; petals 4–5; fruit drupe; seeds exalbuminous; tropics; bitter, tonic, febrifuge.

Genera: **1. Picrasma. 2. Quassia.**

QUASSIA. QUASSIA, *U.S.P.*

Picrasma excelsa, (*Swartz*) *Planchon,*
Quassia amara, *Linné.* } The wood.

Habitat. 1. W. Indies (Jamaica, St. Kitt's, Antigua, St. Vincent. 2. Surinam, W. Indies, Brazil, Guiana, Columbia, Panama.

Syn. Quass., Bitter Wood, Bitter (Ash, Bark) Quassia, Lofty Quassia, Bitterwood Tree; Br. Quassiæ Lignum; Fr. Quassia de la Jamaïque, Bois (amer) de Quassia; Ger. Lignum Quassiæ, Quassiaholz.

Pic-ras'ma. L. fr. Gr. πικρός, bitter—*i. e.,* the plant's chief property.

Quas'si-a. L. fr. *Quassi, Quassy, Quash,* name of Surinam negro slave who used the bark as a secret remedy in curing malignant fevers (febrifuge).

Ex-cel'sa. L. *excelsus; ex,* out, + *celsus,* beyond, surpassing—*i. e.,* highest species of the genus.

A-ma'ra. L. *amarus,* bitter—*i. e.,* the intense bitterness of the wood.

Plants.—*Picrasma excelsa,* tree 15–24 M. (50–80°) high, .6–1 M. (2–3°) thick, erect, spreading; bark grayish-brown, smooth, wrinkled; leaves imparipinnate, 4–5 pairs; leaflets 5–10 Cm. (2–4′) long, ovate, petiolate, when young covered with fulvous down; flowers, Oct.–Nov., small, yellowish-green, panicles, polygamous; fruit Dec.–Jan., black drupe, size of a pea; *Quassia amara,* small branching tree or shrub; flowers bright red, rather large racemes, hermaphrodite, decandrous; fruit 2-celled capsule, seed globular. Wood (*P. excelsa*): *Jamaica,* usually in chips, raspings, shavings, occasionally billets 5–20 Cm.

(2–8′) thick, yellowish-white, with few light gray pieces somewhat coarsely grained; tracheæ in groups 2–6, medullary rays 1–5 cells wide, 10–20 rows deep, calcium oxalate, starch grains; fracture tough, fibrous; odor slight; taste very bitter; *Q. amara: Surinam*, similar to preceding, but billets usually thinner, tracheæ smaller, single or in pairs, medullary rays 1–2 cells wide, 10–30 rows deep, calcium oxalate crystals few or absent. POWDER, yellowish—fragments of tracheæ, bordered pores; wood-fibers, oblique pores; medullary rays and parenchyma with pores, calcium oxalate 4–6-sided prisms, crystal-fibers, starch grains. *Solvents:* water, diluted alcohol. Dose, gr. 15–60 (1–4 Gm.).

FIG. 228.—*Picrasma excelsa.*

Commercial.—Plants resemble our common ash and contribute two varieties: 1, *Jamaica* (*P. excelsa—Quassia* (*Simaruba*) *excelsa*), the larger, and furnishing most of the supply; 2, *Surinam* (*Q. amara*), the smaller and the original source of drug, upon which the slave Quassi established his own and its reputation, being prevailed upon to reveal his secret for compensation, 1756, when the wood was taken to Stock-

holm and soon became a popular remedy in Europe and elsewhere; owing to scarcity, smallness of plant, and great demand there arose the necessity of recognizing the larger and more abundant source. The plants are felled, cut into segments, 1–1.2 M. (3 4°) long, 5–20 Cm. (2–8′) thick, and shipped from Jamaica or Surinam with or without the bark, and upon reaching us are turned into cups, etc., reserving the shavings for store use; the wood at first is white, but changes by age to yellow.

CONSTITUENTS.—Picrasmin (quassiin) .05–.15–.75 p. c., alkaloid (yellowish, blue fluorescence with acidified alcohol), resin, mucilage, pectin; Surinam quassia also contains trace of tannin, giving black or bluish-black with ferric salts.

Picrasmin.—Obtained by neutralizing infusion with sodium hydroxide, precipitating with tannin, decomposing precipitate by heating with lead oxide or lime, dissolving out with alcohol. It is a mixture of two crystalline compounds, *a*-picrasmin, $C_{35}H_{46}O_{10}$, and *b*-picrasmin, $C_{36}H_{48}O_{10}$, homologous with quassiin, $C_{32}H_{40}O_{10}$, of Surinam quassia, crystallizing in needles or prisms, soluble in alcohol, chloroform, water (1200). Dose (amorphous) gr. ½–1 (.03–.06 Gm.); (crystalline) gr. $\frac{1}{32}$–$\frac{1}{3}$ (.002–.02 Gm.).

PREPARATIONS.—1. *Fluidextractum Quassiæ, N.F.* (33 p. c. alcohol). 2. *Tinctura Quassiæ, N.F.* (33 p. c. alcohol). Dose, ♏xv–60 (1–4 cc.).

Unoff. Preps.: Extract (water), gr. 1–3 (.06–.2 Gm.); *Infusion* (Br.), 1 p. c., ℥iv–8 (15–30 cc.); Concentrated Solution, 10 p. c.; Syrup, for fly poison.

PROPERTIES.—Tonic, febrifuge, anthelmintic, simple bitter (similar to calumba).

USES.—Atonic dyspepsia, diarrhea, gastric vertigo, constipation, loss of appetite, poisons flies (*papier mouri*), fish, dogs, rabbits. Infusion (℥viij; 240 cc.), patient being in the knee-chest position, as enema for thread worms (*Oxyu'ris vermicula'ris*) or ascarides of rectum; internally for lumbricoid worms. Large doses cause headache, nausea, vertigo, vomiting, diarrhea, cramps, narcosis. Substituted for hop in making beer and ale.

Allied Plants:

1. *Picram'nia pentand'ra* (?), *Cascara Amarga, Honduras Bark, N.F.*—The dried bark of an undetermined species with not more than 2 p. c. of foreign organic matter; C. America, Large handsome tree. Bark, quills 50 Cm. (20′) long, 3 Cm. (1⅕′) broad, bark 8 Mm. (⅓′) thick, sometimes broken curved pieces, yellowish-brown, grayish lichens, fissured, reddish-brown when cork removed; inner surface brownish, striated, transverse markings, groups of stone cells, odor faint; taste extremely bitter, persistent. Powder, light brown—groups of bast-fibers, crystal-fibers, calcium oxalate prisms, stone cells, medullary ray tissue and parenchyma, starch grains, brown cork, lignified fibers; solvents: water, diluted alcohol; contains picramnine 3 p. c., starch 2 p. c., ash 4.5 p. c. Alterative, bitter aromatic, agreeable flavor.

Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Trifolii Compositum*, 10.8 p. c.: Prep.: 1. *Syrupus Trifolii Compositus*, 30 p. c.

2. *Simaru'ba ama'ra* (*S. officina'lis, S. medicina'lis, Quassia Simaruba*).—The bark (of root), U.S.P. 1820–1870; Guiana to N. Brazil, W. Indies. Tree 15–18 M. (50–60°) high, crooked branches; leaves 22.5–30 Cm. (9–12′) long, leaflets 3–5 pairs, 5–10 Cm. (2–4′) long; flowers yellow; fruit drupe; bark flat, curved, or quilled, .5–1 M. (20–40′) long, 3 Mm. ($\frac{1}{8}$′) thick, yellowish-brown, striate, fibrous,

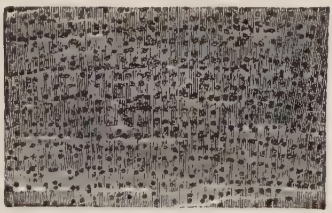


Fig. 229.—Jamaica quassia wood: cross-section magnified 3 diam.

Fig. 230.—*Simaruba amara* (*officinalis*): *1*, calyx and ovary; *2*, corolla; *3*, stamens; *4*, stamen and anther.

bitter; contains picrasmin, resin, volatile oil, calcium oxalate. Tonic, febrifuge, diuretic (large doses cause vomiting and purging); dysentery, diarrhea (*dysentery bark*), etc.; in infusion, decoction. Dose, gr. 10–30 (.6–2 Gm.).

3. *Sima'ba ce'dron* and *S. ferrugin'ea*.—Colombia, Brazil; resembles simaruba, but flowers hermaphrodite; fruit pear-shape, size of hen's egg. Used natively as febrifuge and as antidote to poisonous animal bites.

39. BURSERACEÆ (AMYRIDACEÆ). Myrrh (Frankincense) Family.

Ber-se-ra'se-e. L. *Burser-a* + aceæ, after Joachim Burser, German botanist, at Naples, 17th century. Trees, shrubs. Distinguished by secreting fragrant gum-resinous or resinous juice; leaves compound, dotted; ovary sessile, 1–5-celled, ovules in pairs; flowers perfect; calyx 2–5 divisions; petals 3–5; stamens twice the petals; fruit dry, 1–5-celled; seeds exalbuminous, superior; tropics, bitter, purgative, anthelmintic, poisonous; lumber.

Genus; **1. Commiphora.**

MYRRHA. MYRRH, *U.S.P.*

Commiphora Myrrha, (*Nees*) *Baillon,* or other species. { A gum-resin yielding not less than 30 p. c. alcohol-soluble extractive, nor more than 4 p. c. acid-insoluble ash.

Habitat. E. Africa, S. W. Arabia, Somali country, around Hurrur; 450–900 M. (1500–3000°) elevation.

Syn. Myrrh, Gum Myrrh, Somali (Herabol) Myrrh, Resina Balsamodendri, Gummi-resina Myrrha; Fr. Myrrhe; Ger. Myrrha, Myrrhe.

Com-miph'o-ra. L. fr. Gr. κόμμι gum, + φέρος φέρειν bears, to bear—*i. e.*, produces gummy exudation.

Myr'rha. L. fr. Gr. μύρρα, classic name—Ar. *murr*; Heb. *mar*, bitter—*i. e.*, gum-resin has bitterish taste.

PLANT.—Low, stunted bush or small tree 2.5–3 M. (8–10°) high; trunk considerable size, with many irregular, knotty, abortive branches at right angles, terminating in sharp spines; bark whitish-gray; leaves trifoliate, 2.5 Cm. (1′) long, petiolate; leaflets sessile, 12 Mm. (½′) long, unequal, obovate, central one the largest; flowers diœcious; fruit 12 Mm. (½′) long, pyriform. GUM-RESIN (myrrh), in rounded, irregular tears or masses of agglutinated tears, reddish-brown, covered with yellowish dust; fracture waxy, granular, conchoidal, internally nearly white spots or lines, oily, translucent at edges; odor balsamic, aromatic; taste aromatic, bitter, acrid; triturated with water—brownish-yellow emulsion; with alcohol—brownish-yellow tincture, changing with nitric acid to purplish-red; macerated with water—neither swells nor dissolves. POWDER, yellowish-brown—numerous angular fragments of resin and gum, few fragments of lignified tissue, few starch grains. Reject tears dissolving completely in water, or those swelling with water. *Solvent:* alcohol. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 231.—*Commiphora Myrrha: 1,* fruit-bearing twig; *2,* ripe fruit; *3,* and *4,* vertical section of pistillate and staminate flowers respectively; *5* embryo.

ADULTERATIONS.—Gum-resin of allied species (bdellium, etc.—fracture more transparent or opaque, odor and taste different), vegetable fragments, sand, salt, dark gums swelling or adhesive with water.

Commercial.—Trees form an undergrowth in the Red Sea coast forests where vegetation is scant, water scarce, and temperature high. Myrrh is formed in the bark and pith, and exudes spontaneously, like cherry-tree gum, or from artificial incisions through the stem-bark,

being at first a juice, then oily, soft, yellowish, golden, finally hard and reddish. It is collected mostly by the Somali, both at home and across the Aden Gulf, Arabia, and formerly entered commerce via Egypt and Lavant ports, hence the name *Turkey myrrh*, but now is conveyed to the great fair of Berbera, there purchased by the Banians of India, and shipped via Aden to Bombay, where it is assorted into grades (bdellium separated) and put into chests, 100–200 pounds (46–90 Kg.). There are three varieties: 1, *Turkey* (*African*), the best—our official kind; 2, *Arabian*, cultivated in S. Arabia, east of Aden, called by Arabs *mur*, by Somalis *mulmul*, *heerabul*, resembles the preceding, but smaller, tougher, without white lines in fracture, less resin, volatile oil and fragrance, only 25 p. c. soluble in alcohol; 3, *Indian* (*Myrrha Indica*), called natively *bissabul*, by Somalis *hebbakhade*, resembles dark myrrh, but has mushroom-like odor, strong, almost acrid, taste; contains resin 21 p. c., volatile oil 8 p. c., many impurities; in commerce as Opopanax.

Constituents.—Volatile oil 4–8 p. c., Resin 25–40 p. c., Gum 40–60 p. c., bitter principle (glucoside, soluble in alcohol, water), ash 3–8.5 p. c.—mostly calcium carbonate.

Volatile Oil, $C_{10}H_{14}O$.—Also called *myrrhol* or *myrrhenol*, identical in formula with thymol and carvol, but distinct from them; easily resinifies, pale yellow, thick liquid, sp. gr. 0.988.

Resin, $C_{48}H_{32}O_{10}$.—Often called *myrrhin*, soluble in alcohol, chloroform, ether; consists of 2 parts—one soft the other hard and acid, the latter yielding protocatechuic acid and pyrocatechin, and further divisible into 2 parts—β and γ commiphoric acids.

Gum.—Two kinds, one soluble, the other swelling—galactose and arabinose—in water, adhesive, making stable paste; one precipitated by neutral, the other by basic lead acetate.

Preparations.—1. *Tinctura Myrrhæ.* Tincture of Myrrh. (Syn., Tr. Myrrh.; Fr. Teinture de Myrrhe; Ger. Myrrhentinktur.)

Manufacture: 20 p. c. Similar to Tinctura Cardamomi Composita, page 137; menstruum: alcohol. Dose, ♏xv–60 (1–4 cc.); mostly used externally. 2. *Pilulæ Aloes et Myrrhæ, N.F.*, 1 gr. (.06 Gm.). 3. *Tinctura Aloes et Myrrhæ, N.F.*, 10 p. c. 4. *Tinctura Capsici et Myrrhæ, N.F.*, 12 p. c. 5. *Pilulæ Antiperiodicæ, N.F.*, $\frac{1}{8}$ gr. (.008 Gm.). 6. *Pilulæ Rhei Compositæ, N.F.*, 1 gr. (.06 Gm.). 7. *Tinctura Antiperiodica, N.F.*, $\frac{1}{5}$ p. c.

Unoff. Preps.: Fluidextract, ♏v–30 (.3–2 cc.). *Compound Iron Mixture* (*Griffith's*), 1.8 p. c. Plaster.

Properties.—Stimulant, tonic, expectorant, emmenagogue, astringent, carminative, vulnerary; increases circulation and the number of white blood corpuscles; it is eliminated by the genito-urinary and bronchial mucous membranes, augmenting and disinfecting their secretions; large doses vomit, purge, decrease bronchial secretion. Locally, stimulant, disinfectant, and antiseptic to mucous membranes, ulcerated surfaces, etc.

BURSERACEÆ

USES.—Atonic dyspepsia, amenorrhea, anemia, bronchial catarrh, cystitis, pharyngitis, chronic uterine and vaginal leucorrhea. Locally —ulcerated spongy gums, diseased mucous surfaces, relaxed throat, ptyalism, ozena, indolent ulcers; tincture freely diluted with water a good disinfectant gargle to ulcerated sore throat; much used in tooth powders and wash.

Allied Products:

1. *Commiphora Mu'kul, Indian Edellium,* and *C. africa'na, African Bdellium.*—Both occur in tears resembling myrrh, yellowish-brown, dusty, translucent, the former only slightly aromatic, not bitter, the latter with aroma distinct from myrrh, quite bitter; with nitric acid—no purplish-red; both contain volatile oil, resin, gum—the latter a bitter principle; a third variety is non-translucent; yielding a tincture blackened by ferric salts. *C. (Balsemoden'dron) Opobal'samum, Mecca Balsam (Gum).—Bal'samum Gileaden'se, Balm of Gilead.* Possibly the myrrh of the Bible; opaque, yellowish, fragrant, viscid liquid; contains volatile oil 10–30 p. c.; soft resin 70 p. c., hard resin 12 p. c.

2. *Boswel'lia Carte'rii, Olibanum, Frankincense.*—E. Africa, S. Arabia. This gum-resin exudes from incisions made in the bark; occurs in yellowish-brown tears covered with white dust; odor balsamic, terebinthinate; taste balsamic, bitter; partly soluble in alcohol; yields with water milk-white emulsion; contains volatile oil 4–7 p. c. (mostly *olibene*, $C_{10}H_{16}$), resin 56–72 p. c., gum (resembles arabin) 30 p. c., bitter principle, ash 3. p. c. Stimulant, expectorant. Dose, gr. 15–30 (1–2 Gm.), in emulsion, plaster, or fumigation.

3. *Cana'rium commu'ne, Manila Elemi, Elemi.*—Philippine Islands. The oleoresin exudes from incisions in the bark of a tall tree; it is soft, yellowish, granular crystalline, when cold friable; odor strong, resembling fennel and lemon, terebinthinate; taste bitter, pungent; contains volatile oil 10–15 p. c., amorphous resin (*breïn*) 60 p. c. (soluble in cold alcohol), crystalline resin (*amyrin*) 25 p. c., bryoidin, breïdin, elemic acid, $C_{35}H_{46}O_4$ (crystalline). Stimulant, irritant; in plaster and ointment.

Allied Plants:

1. *Gua'rea (Sycocar'pus) Rus'byi, Cocillana, N.F.*—Meliaceæ. The dried bark with not more than 5 p. c. of wood or other foreign organic matter; Bolivia—river-bottoms. Tree resembles a large apple tree. Bark, in flat, curved pieces, variable length and width, up to 2 Cm. ($\frac{4}{5}'$) in thickness, externally fissured, gray-brown, ashy gray from lichens, orange-brown where cork removed, inner surface brownish, longitudinally striate; inner bark thicker than outer; fracture coarsely splintery-fibrous, soft; odor characteristic; taste slightly astringent, peculiar, slightly nauseous. Powder, light brown—lignified fibers, crystal-fibers, calcium oxalate prisms, medullary ray cells with brownish contents or starch grains, abundant stone cells, fragments of cork tissue; solvent: 75 p. c. alcohol; contains rusbyine, resins (2), alkaloid,

fat, tannin, ash 10 p. c. Expectorant (superior to ipecac), laxative, emetic; bronchitis, bronchial pneumonia, phthisis. Dose, gr. 5–20 (.3–1.3 Gm.); 1. *Fluidextractum Cocillanæ*. Syrup, Elixir, each 10 p. c., dose, ʒj–2 (4–8 cc.).

2. *Me'lia Azed'arach, Margosa Bark, Pride of India.*—The bark of the root, U.S.P. 1820–1880; China, India, cultivated, S. United States. Beautiful tree 9–12 M. (30–40°) high, leaves imparipinnate; flowers lilac color; fruit drupe, yellow, size of cherries, poisonous pulp; never leafless. Bark curved or quilled, 5–7.5 Cm. (2–3′) long, 5 Mm. ($\frac{1}{5}$′) thick; outer surface reddish with irregular blackish ridges; inner surface whitish or brownish, striate, sweet, bitter, nauseous; contains resin, tannin, sugar. Used for lumbricoid worms, emetic. Dose, gr. 15–60 (1–4 Gm.), in decoction, tincture (diluted alcohol).

40. POLYGALACEÆ. Milkwort Family.

Pol-i-ga-la'se-e. L. *Polygal-a* + aceæ, fr. Gr., πολύς much, + γάλα, milk—*i. e.*, believed to increase lacteal secretion in female animals. Shrubs, herbs. Distinguished by bitter, acrid properties and milky roots; flowers papilionaceous; petals 3–5, more or less united; sepals 5, of which 2 anterior are lateral, larger; petaloid, forming the wings to the flowers; stamens 8, monadelphous; ovary 2–3-celled; anthers open at apex; fruit capsular; universal; bitter, acrid; tonic, stimulant, febrifuge, astringent, emetic, purgative, diuretic, sudorific, expectorant; fruit edible, saponaceous.

Genus: **1. Polygala.**

SENEGA. SENEGA, *U.S.P.*

Polygala Senega, *Linné.* { The dried root, with not more than 5 p. c. of stems, and other foreign organic matter.

Habitat. United States, in woods and rocky soil; Canada to S. Carolina, west to Wisconsin.

Syn. Seneg., Senega Snakeroot, Seneca Snakeroot, Seneka, or Snake Root, Rattlesnake Root, Milkwort, Mountain Flax; Br. Senegæ Radix; Fr. Polygala de Virginie; Ger. Senegawurzel.

Po-lyg'a-la. L., see etymology, above, of Polygalaceæ.

Sen'e-ga. L. fr. the Seneca (Senega) tribe, one of the five N. American Indian tribes; they inhabited W. New York and used this plant as a remedy for snake-bites.

Plant.—Perennial herb; stems several, erect, 22.5–37.5 Cm. (9–15′) high, smooth, round, leafy, occasionally reddish or purplish below, green above; leaves 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}$′) wide, lanceolate, sessile, margins rough, bright green; flowers May–June, small, diadelphous, white, spike 2.5–5 Cm. (1–2′) long, calyx showy; sepals 5 (3 small, green; 2 larger, petaloid, called wings); corolla small, closed; fruit capsule, 2-celled, compressed, 2-seeded, black. Root,

usually in pieces; when entire, slenderly conical, with an enlarged crown, 3–15 Cm. ($1\frac{1}{5}$–6′) long, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, tortuous, somewhat branched, few rootlets, crown knotty with numerous buds and short stem-bases, brownish-yellow, crown darker and rose-tinted, longitudinally wrinkled, frequently with a distinct ridge (keel); fracture short, wood pale yellow; usually eccentrically developed and in pieces; odor suggesting methyl salicylate; taste sweetish, afterward strongly acrid. POWDER, grayish-yellow, sternutatory—fragments of cork, parenchyma and sieve tissue developing oily globules, tracheæ, tracheids, numerous pores, wood-fibers, lignified medullary ray cells. *Solvents:* boiling water; alcohol; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 232.—*Polygala Senega.*

FIG. 233.—*Polygala Senega:* root, natural size; *b*, *b*, the keel.

ADULTERATIONS.—Allied species, also gillenia, triosteum (rhizome and roots), American gentians (rootlets), often to 25 p. c.—result of careless collection and intentional fraud; in Europe occasionally the underground portion of *Cynan'chum Vincetox'icum*. Of these none has a keel, some contain starch, and all differ in odor, color, and taste.

Commercial.—The official root, as well as some of the growing plants of this genus emit a slight wintergreen odor; the southern root is smaller

and usually paler, while the Manitoba is larger and stouter, often dark, with purple discoloration about the crown; the large, broad-leaved form is considered var. *latifo'lia*. Root should be collected in the autumn, and comes chiefly from Minnesota and northward.

Constituents. — Saponin-like compound 5–6 p. c., composed of senegin 1.5 p. c., and polygalic acid 4 p. c. (analogous to saponin and components, quillaja-sapotoxin, quillajic acid, of quillaja), fixed oil 8–9 p. c., volatile oil .12 p. c., methyl salicylate (increasing with age), resin, polygalite, sugar 7 p. c., pectin and albuminoids 18.40 p. c., malates, yellow coloring matter, ash 4–5 p. c.

Fig. 234.—Senega: transverse sections magnified.

Senegin (*polygalin, saponin*), $C_{32}H_{54}O_{18}$.—Obtained by exhausting root with 60 p. c. alcohol, concentrating, precipitating with alcohol and ether; mother-liquor contains the salt of an organic acid. It is a neutral glucoside, white, amorphous, inodorous powder, insoluble in alcohol, not precipitated by normal lead acetate, and forms soapy emulsion with boiling water; by hydrochloric acid decomposed into glucose and sapogenin, $C_{14}H_{22}O_2$.

Polygalic Acid, $C_{19}H_{30}O_{10}$.—Sparingly soluble in alcohol, insoluble in ether or chloroform, precipitated by neutral and basic lead acetates.

Fixed Oil.—Obtained from root by ether; contains virgineic acid which gives disagreeable aroma.

Volatile Oil.—This is a mixture of valer(ian)ic ether and methyl salicylate.

Preparations.—1. *Fluidextractum Senegæ*. Fluidextract of Senega. (Syn., Fldext. Seneg., Fluid Extract of Senega; Fr. Extrait fluide de Polygale de Virginie; Ger. Senegafluidextrakt.)

Manufacture: Macerate, percolate 100 Gm. with alcohol 200 cc. + water 100 cc., proceed with menstruum (same strength) until exhausted, reserve first 80 cc., evaporate remainder to soft extract, which dissolve in the reserve, add ammonia water gradually until faintly alkaline (slight odor of ammonia), and menstruum q. s. 100 cc. Dose, ♏v–30 (.3–2 cc.).

Preps.: 1. *Syrupus Senegæ*. Syrup of Senega. (Syn., Syr. Seneg.; Fr. Sirop de Polygale; Ger. Senegasirup.)

Manufacture: 20 p. c. Mix ammonia water 1 cc. with fluidextract of senega 20 cc., add syrup q. s. 100 cc.; mix well. Dose, ʒj–2 (4–8 cc.).

2. *Syrupus Scillæ Compositus*, 8 p. c. 3. *Mistura Pectoralis, N.F.*, 3.5 p. c.

Unoff. Preps.: Abstract, gr. 5–10 (.3–.6 Gm.). *Infusum Senegæ* (Br.), 5 p. c., ʒiv–16 (15–60 cc.). *Liquor Senegæ Concentratus*, 50 p. c.,

℥ss–j (2–4 cc.). *Tinctura Senegæ* (Br.), 20 p. c. (60 p. c. alcohol), ℥ss–j (2–4 cc.).

PROPERTIES.—Stimulating expectorant, diuretic, diaphoretic, irritant. Produces throat and gastro-intestinal irritation, some salivation with inclination to cough, increased bronchial secretion; large doses vomit and purge. Insufflation causes sneezing, coughing, and nasal catarrh. Externally—an irritant to the skin. Senegin is a violent irritant, heart depressant, likewise same to vascular, nervous, and muscular systems. It is excreted by kidneys, skin, bronchial mucous membrane, all being stimulated and irritated by it.

USES.—Secondary stage of acute and in chronic bronchitis, in typhoid pneumonia, asthma, croup, renal dropsy, promotes expectoration; no value when mucus tough and scanty, or unless the primary acute inflammation has been subdued; slight value in dropsy. In amenorrhea, give decoction two weeks before each menstruation, chronic rheumatism, rheumatic paralysis; senegin in gr. 2 (.13 Gm.) doses for uterine hemorrhage. Popular with North American Indians for rattlesnake and other snake-bites.

Allied Plants:

1. *Polygala al'ba, White, Texas* or *False Senega.*—West of Mississippi River; root 6 Mm. ($\frac{1}{4}'$) thick, resembling official, but has a lighter color internally, also a cylindrical wood, and is destitute of keel; contains polygalic acid 3 p. c.; yields light-colored infusion and tincture. *P. Boyki'nii*, Southern States; like the *P. alba*, only thinner, yet some consider both to be one and the same species.

2. *P. polyg'ama* (*rubel'la*), *Bitter Polygala.*—The root and herb, U.S.P. 1820–1870; Canada–Florida. Plant 15–22.5 Cm. (6–9′) high; leaves mucronate; flowers purple; keel crested, shorter than the wings; fruit 2-seeded, capsule oblong; contains bitter principle analogous to senegin; similar to *P. ama'ra* of Europe. Tonic in bronchial catarrh; large doses laxative, diaphoretic.

41. EUPHORBIACEÆ. Spurge Family.

U-for-bi-a'se-e. L. *Euphorbi-a* + aceæ, Gr. Εὔφορβος, well fed, fr. εὖ, well, + φέρβειν, to feed, after Euphorbus, physician to Juba, king of Mauritania. Trees, shrubs, herbs. Distinguished by containing acrid, milky, poisonous juice; flowers unisexual; calyx usually wanting; corolla none; ovary superior, 3-celled, ovules 2 from each cell; fruit tricoccous, 3–6-seeded capsule; temperate climates, tropics; emetic, purgative, diuretic, rubefacient, poisonous, starchy food, caoutchouc, aromatic, tonic, dyes, wood, edible roots.

Genera: **1. Croton. 2. Ricinus.**

CROTON TIGLIUM. CROTON OIL PLANT.

Oleum Tiglii. Croton Oil, *U.S.P.*

Croton Tiglium, *Linné.* } A fixed oil expressed from the seeds.

Habitat. India, Philippine Islands, (Ceylon, Borneo, Japan, Hindustan, Moluccas); cultivated.

Syn. Purging Croton, Croton Seeds, Grana Tiglii, Grana Molucca; Ol. Tiglii; Br. Oleum Crotonis; Fr. Graine de Tilly ou des Moluque, Croton (Semence); Huile de Croton Tiglium; Ger. Granatill, Purgirkörner; Krotonöl.

Cro'ton. L. fr. Gr. κροτών, dog-tick—*i. e.*, from the resemblance of the seed.

Tig'li-um. L. fr. Gr. τιλάω, to have a thin stool—*i. e.*, its medicinal property; croton plant seeds once called *grana tiglii* or *grana tilli.*

Fig. 235.—*Croton Tiglium.*

Plant.—Small tree, 4.5–6 M. (15–20°) high, trunk crooked; bark smooth, light brown, that of branches scarred from fallen leaves; leaves 10–12.5 Cm. (4–5′) long, 5 Cm. (2′) wide, glabrous, ovate, serrate, bright green, veins prominent beneath, petioles 2.5–5 Cm. (1–2′) long; flowers, monœcious, racemes—staminate at upper part—pistillate at lower, greenish-white; fruit capsule, size of hazelnut, smooth, brownish-yellow, 3-celled (tricoccous), each cell 1-seeded, dehiscent. Seed, 12 Mm. ($\frac{1}{2}$′) long, 8 Mm. ($\frac{1}{3}$′) wide, ovoid, caruncle inconspicuous, raphe fine, testa thin, roughish, not shiny, brittle, gray-brown, mottled or blackish, albumin oily; integuments 33–36 p. c., kernel 64–67 p. c.

Constituents.—Fixed oil 30–40 p. c. (from entire seed). 50–55 p. c. (from kernels alone), proteins, albumin, etc.

EUPHORBIACEÆ

Oleum Tiglii. Croton Oil.—This fixed oil obtained from the seed, deprived of shell or testa, chiefly by expression, is a pale yellow, brownish-yellow, somewhat viscid and slightly fluorescent liquid, slight characteristic odor, mild, oily, afterward acrid, burning taste (must use great caution in tasting and handling, as it produces pustular eruptions when applied to the skin), soluble in ether, chloroform, fixed or volatile oils, slightly in alcohol (when fresh in 55–70 parts, when 3–4 years old in 20 parts), acid reaction, sp. gr. 0.943, congeals at —16° C. (3.2° F.); contains glycerides of stearic, palmitic, myristic, lauric, and oleic acids, and of the volatile acids—acetic, butyric, formic, valeric, tiglic (tiglinic—oleic series), $C_5H_8O_2$, also crotonol, $C_{18}H_{28}O_4$. The purgative principle is insoluble in alcohol, the vesicating, croton-resin, $C_{13}H_{18}O_4$, is soluble, and this latter, with several inactive oily acids, constitutes crotonolic (crotonoleic) acid, closely related to oleic and ricinoleic acids, which, together with its glyceride, is believed by some to be both purgative and vesicating; it is oily, readily decomposed, slightly acid, forms salts, soluble in alcohol, severe irritant to skin and mucous membranes; croton-resin is hard, brittle, pale yellow, soluble in alcohol, ether, chloroform, vesicating property destroyed by long boiling with potassium or sodium hydroxide solution. *Tests:* 1. Heat gently with dehydrated alcohol (2)— clear solution from which the oil separates, partially or completely, on cooling. 2. Shake vigorously for a few minutes 2 cc. with 1 cc. each of fuming nitric acid and distilled water—does not solidify, partially or completely, on standing 24 hours (abs. of foreign oils). Should be kept dark, in small, well-stoppered bottles. Dose, ♏$\frac{1}{3}$–2 (.02–.13 cc.).

ADULTERATION.—SEED: Those of *C. oblongifo'lius*, *Kuli Seed*—larger, dark grayish-brown; root-bark popular in India; OIL: Various fixed non-drying oils, castor oil, etc.

FIG. 236.—*Croton Tiglium:* lateral and ventral view and longitudinal section of seed.

Commercial.—Plant—all parts used in India from early times; root as a drastic cathartic in dropsy; wood diaphoretic (small doses), purgative, emetic (large doses); leaves, owing to acridity, when chewed and swallowed, irritant—inflaming lips, mouth, throat and alimentary canal. Seed most active, having been introduced into Europe, 1630, as *grana Moluccа*, *grana tiglia*, etc., and now imported mostly for the oil which is extracted by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether). The first method is preferred, and consists in crushing and expressing the seed without integuments at moderate temperature, thereafter digesting the marc in alcohol at 54° C. (130° F.), again expressing and reclaiming alcohol. That extracted in India, from seed roasted slightly to separate easily the shells (using only the kernels), is pale yellow, while that extracted in Europe (also from kernels alone but from which shells have been removed without

heat) is reddish-brown, due to greater age of the seed and the higher heat employed in expression.

PREPARATIONS.—(Unoff.): *Collodium Tiglii*, 10 p. c. *Linimentum Tiglii* (*Crotonis*), 13 p. c. *Compound Liniment*, 20 p. c. + oil of sassafras 20, oil of turpentine 20, olive oil 40. Emulsion. Pill. Tincture; or may give on lump-sugar.

FIG. 237.—*Croton Eluteria.*

PROPERTIES.—Powerful purgative, irritant poison, rubefacient, all due to local action; it is drastic, causing in 1–2 hours copious watery stools. Overdoses cause intense congestion of intestinal canal, vomiting, purging, possibly death from gastro-enteritis; an alkali increases its purgative effect, which is experienced often by even smelling, or rubbing the oil on the skin.

USES.—Mania, coma, obstinate constipation, lead colic, tenia, dropsies, dysentery, apoplexy, paralysis. Externally—rheumatism, gout,

neuralgia, glandular swellings, pulmonary and laryngeal troubles, bronchitis, ovaritis, pleurisy. Can apply the oil directly to the surface by rubbing until dry ♏j–2 (.06–.13 cc.), or the same quantity dissolved in either, chloroform, olive oil, soap liniment, alcohol, ether, or oil of turpentine.

Poisoning: Have abdominal pain, great congestion of intestinal canal, vomiting, purging (fluid stools), pulse small and thready, skin moist, face pinched, prostration, collapse, death possibly from gastroenteritis. Evacuate stomach, give milk, olive oil, mucilage, white of egg, gelatin, soup, opium, alcoholic liquids, artificial heat, hot poultice or fomentations to stomach, spirit of camphor, digitalis, warm stimulating baths.

Allied Plants:

1. *Croton Elute'ria, Cascarilla.*—The dried bark, U.S.P. 1820–1890; Bahama Islands. Plant 1.5–6 M. (5–20°) high, stem, 2.5–20 Cm. (1–8′) thick, leaves 2.5–7.5 Cm. (1–3′) long, ovate, lanceolate, petiolate, under side bronzed-silver, flowers monœcious, white, odorous, fruit

Fig. 238.—Cascarilla: bark quill.

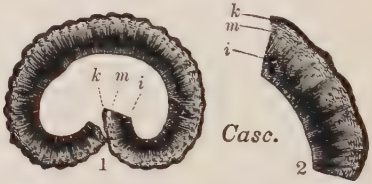


Fig. 239.—Cascarilla: *1*, cross-section enlarged; *2*, cross-section 8 times enlarged; *k*, cork; *m*, middle bark; *i*, liber.

15 Mm. (⅗′) thick, ovate, silvery-gray, 3-furrowed, 3-celled; bark in quills or curved pieces, 10 Cm. (4′) long, 3–8 Mm. (⅛–⅓′) broad, 1–3 Mm. (1/25–⅛′) thick, silvery-gray from lichen, or brown when this is absent, the exposed surface wrinkled, transversely fissured, inner surface reddish-brown, smooth, fracture short, resinous, thin whitish medullary rays, odor aromatic, musk-like, especially when burned, taste aromatic, bitter; contains volatile oil 1.6 p. c., cascarillin, betaine, resin 15 p. c., tannin, pectin, vanillin. Stimulant, tonic, febrifuge; intermittents, dyspepsia, diarrhea, poor substitute for cinchona. Dose, gr. 15–30 (1–2 Gm.); tincture, 20 p. c. (70 p. c. alcohol), dose, ʒss–2 (2–8 cc.); extract, dose, gr. 5–8 (.3–.5 Gm.); infusion, 5 p. c., dose, ʒiv–8 (15–30 cc.). *C. lu'cidus*, growing with the preceding plant; *C. ni'veus* (*pseudochi'na*), *Copalchi Bark*, Mexico, and *C. Malam'bo*, *Malambo Bark*, Venezuela. All produce barks that resemble closely.

2. *Mallo'tus philippinen'sis, Kamala, Rottlera.*—The glands and hairs from the capsules, U.S.P. 1860–1890; Philippine Islands, India, China. Small tree, 6 M. (20°) high; bark pale, branches with ferruginous tomentum; leaves 7.5–15 Cm. (3–6′) long, petiolate, ovate,

entire, coriaceous, glabrous, under side rusty; flowers diœcious, tomentous; fruit tricoccous, globular capsule, size of small cherry, externally 3-furrowed, covered with red powder. Glands and hairs (kamala) glandular, mobile, brick-red powder, inodorous, nearly tasteless; under microscope as stellately arranged colorless hairs mixed with depressed globular glands, containing numerous red club-shaped vesicles; burns like lycopodium, and ash should not be more than 4–8 p. c. Capsules when collected are rolled about in baskets, and

FIG. 240.—Kamala: magnified 190 diam.

FIG. 241.—*Mallotus philippinensis: a*, twig of staminate plant; *b*, twig of pistillate plant.

rubbed with hands to remove glands and hairs, which in turn, passing through the meshes, are caught upon cloths; contain resins (2—rottlerin,

isorottlerin) 80 p. c., wax, coloring matter, albuminous matter 7 p. c., cellulose 7 p. c., ash 4 p. c. Tenifuge (anthelmintic, purgative); tape-worm, sometimes for the round- and seat-worms; also externally in scabies, skin affections, herpetic ringworm. Next to male-fern for tenia, being better than kousso or turpentine. *Adulterations:* Wurrus, resins, etc., used not only as vermifuge, but in skin affections and as dyes; also many fruits—Soria, Satze (Tatze), Embelia, and the bark of *Albiz'zia* (*Acacia*) *anthelmin'tica* (Mesenna, Mussena, Busenna—Abyssinian names for acacia bark) is employed as tenifuges in India and Abyssinia; also powdered leaves, fruit-stalks, colored starch, earth, sand, in all sometimes 60 p. c.—increasing ash 65–75 p. c. Dose, ʒj–2 (4–8 Gm.); fluidextract, ʒj–2 (4–8 cc.); tincture, 30 p. c. (alcoholic), ʒj–4 (4–15 cc.); electuary; syrup; mucilage.

RICINUS. CASTOR OIL PLANT.

Oleum Ricini. Castor Oil, *U.S.P.*

Ricinus communis, *Linné.* } A fixed oil obtained from the seeds.

Habitat. India; cultivated in tropics; India, Italy, Spain, Sicily, United States.
Syn. Palma Christi, Castor Bean, Mexico Seed, Oil Plant, Oil Seed (Nut); Fr. Ricin (Graine); Ger. Wunderbaum; Ol. Ricin., Oleum Palmæ Christi; Fr. Oleum e Semini Ricini, Huile de Ricin; Ger. Rizinusöl.
Ric'i-nus. L. a bug, dog-tick—*i. e.*, from the resemblance of the seed.
Com-mu'nis. L. common, general—*i. e.*, it is the ordinary common species.

Plant.—This is quite variable in habit and appearance—in tropics a tree 9–12 M. (30–40°) high, in warm or temperate regions a woody bush 3.6–4.5 M. (12–15°) high; in Middle United States with herbaceous stems 1.6–3 M. (5–10°) high, hollow, smooth, glaucous, purplish bloom above; leaves with blade 15–20 Cm. (6–8′) broad, palmately divided (¾ depth) into 7–11 lanceolate, serrate segments, smooth, bluish-green, paler beneath, on long, curved, cylindrical, purplish petioles; flowers July, monœcious, large, apetalous, racemes, staminate below, pistillate above; fruit tricoccous capsule 2.5 Cm. (1′) long, blunt, greenish, deeply grooved, sometimes smooth, usually spinescent on the 3 projecting sides, 3-celled, each cell 1-seeded, which is expelled in Aug.-Sept. by capsule dehiscing into 6 valves. Seed 12 Mm. (½′) long, 6 Mm. (¼′) broad, 3 Mm. (⅛′) thick, size of a coffee grain, with caruncle, raised raphe, grayish, marbled with blackish spots or bands of various tints and shapes, smooth, shining.

Constituents.—Seeds (testa 23.82 p. c., kernel 69.09 p. c.) yield fixed oil 35–45 p. c., gum (mucilage) 2.4 p. c., starch and lignin 20 p. c., albumin 5 p. c., ricinine, proteins (emulsin), sugar, ash (testa 10 p. c., kernel 4 p. c.). The poisonous principle, ricin, is an albuminoid, soluble in a 10 p. c. solution of sodium chloride, precipitated by acids, coagulated by heat; harmless to chickens.

Oleum Ricini. Castor Oil.—This fixed oil, obtained from the seed chiefly by expression, is a pale, almost colorless, transparent, viscid liquid, faint, mild odor, bland, slightly acrid, usually nauseating taste, miscible with dehydrated alcohol or glacial acetic acid; sp. gr. 0.955; at 0° C. (32° F.) separates into crystalline flakes, at —18° C. (—.4° F.) congeals into yellow mass; contains mostly triricinolein (the glyceride of ricinoleic acid), $C_3H_5(C_{18}H_{33}O_3)_3$, also palmitin, ricinoleic acid (ricinic acid), $C_{18}H_{34}O_3$, which is a viscid oil readily converted by

FIG. 242.—*Ricinus communis: a*, stamen; *b*, anther; *c*, stigmas; *d*, transverse section of capsule; *e*, seed; *f*, embryo.

nitrous acid into ricinelaidic acid, crystalline, melting at 50° C. (122° F.). *Tests:* 1. Only partly soluble in petroleum benzin (dif. from most other fixed oils). 2. Soluble (clear) in an equal volume of alcohol (abs. of foreign fixed oils). Should be kept in well-closed containers. Dose, ℥j–8 (4–30 cc.).

ADULTERATIONS.—Rare: Cottonseed, rapeseed, sesame, and mineral oils—detected by decreased solubility in alcohol and preceding tests.

Commercial.—Plant, called Palma Christe from supposed shape of leaves resembling Christ's hand, is cultivated extensively in the United

States for the oil which is extracted from the seed by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether). The first method is preferred, and consists in crushing and freeing seed of the integuments, dark skin, etc., and expressing at 60° C. (140° F.), or in heating clean seed in shallow tanks short of scorching, 65° C. (150° F.), to render oil more fluid, and expressing them hydraulically in hempen bags between hot iron plates; while this affords the greatest yield of oil it is of inferior quality, the best being from hand-screw presses. This white oil now is run into iron vats with water, boiled to separate impurities (albumin being coagulated and removed by skimming, mucilage and starch being dissolved in water), strained, reboiled (to destroy acidity), strained, and, if opaque, treated with fuller's earth, or magnesium oxide (1 p. c.) and animal charcoal (2.5 p. c.), filtered through paper and felt, and put into cans or barrels, constituting as such *cold-pressed castor oil;* by grinding marc with water and expressing may obtain 6–8 p. c. additional good oil; the yield by cold expression is 25–30 p. c., with heat 35–45 p. c. The method by decoction, owing to water dissolving poisonous ricin and heat increasing

a *b* *c* *d*

Fig. 243.—*a*, Ricinus fruit; *b*, seed; *c* and *d*, longitudinal sections.

oil's acidity, is not so desirable, consisting in crushing the seed after removing husks (testa), boiling with water (oil floating on surface), straining, reboiling to dissipate acrid principle, straining, filtering; this oil usually is brownish, acrid, irritating, and comes from E. and W. Indies. The method by solution causes the oil to turn rancid quicker, in spite of which it is preferred in France and Italy, being considered more agreeable and effective. The so-called popular Italian castor oil is produced extensively around Verona, Italy, where only fresh seed thoroughly deprived of coating are expressed hydraulically without heat; this oil although remarkedly free from disagreeable odor and taste is none the less active. An ethereal or alcoholic tincture of the seed is claimed to be less irritating and nauseous. The press-cake, usually 60 p. c., is employed chiefly as a fertilizer, and, after the removal of ricin by salt solution, as a cattle-food. In India there are two varieties of seeds, *large* and *small*, the latter yielding the best oil.

Preparations.—1. *Collodion Flexile*, 3 p. c. 2. *Emulsum Olei Ricini, N.F.*, 35 p. c., + acacia 9, tincture of vanilla 2.5, syrup 20,

water q. s. 100. Dose, ʒj–2 (30–60 cc.); 3. *Oleum Ricini Aromaticum, N.F.*, 97 p. c., + gluside $\frac{1}{20}$, oil of cinnamon $\frac{3}{10}$, oil of clove $\frac{1}{10}$, vanillin $\frac{1}{10}$, coumarin $\frac{1}{100}$, alcohol 3. Dose, ʒiv–8 (15–30 cc.). 4. *Linimentum Sinapis Compositum, N.F.*, 15 p. c.

Unoff. Preps.: Castor Oil Mixture (Br.), 37.5 p. c., ʒj–2 (30–60 cc.); Capsules, Paste.

Properties.—Purgative, demulcent. It is non-irritating until the duodenum is reached, where the bile and pancreatic juice decompose it into glycerin and ricinoleic acid; this latter combines with sodium, forming sodium rincinoleate, which mildly irritates the bowels, causing purgation, stimulating muscular glands and coat, but not the liver; acts in 4 to 6 hours, producing liquid stools without much pain or tenesmus, followed by sedative effect on intestines. Leaves are said to be galactagogic when applied to breast, and to impart cathartic power to the milk and various secretions. Glycerin increases the purgative effect.

Uses.—Constipation, colic, diarrhea, dysentery, enteritis in pregnancy, puerperal state, tape and lumbricoid worms, traumatic fever, renal calculi, night-sweats, amenorrhea, engorged liver, hemorrhoids, cystitis, gonorrhea. In dysentery may add laudanum, ♏xx (1.3 cc.), to each dose in order to counteract any pain, tenesmus, or exhaustion from frequent passages; externally applied to warts, as a local sedative, protective; base of Turkish-red oil used in calico dyeing and printing.

Administration.—In emulsion flavored to suit, or equal quantities of oil and either heavy sarsaparilla, peppermint, or cinnamon syrup beaten together, or take with soda water, malt liquor, orange juice, coffee, etc. All disguise very effectively the nauseating oil taste. At one time the seed were employed, but action too violent; their griping principle (ricin) is said to reside in the embryo and testa, hence to make best oil most of these should be removed before expressing.

Allied Plants:

1. *Stillin'gia sylvat'ica, Stillingia, Queen's Root, N.F.*—The dried root with not more than 3 p. c. of foreign organic matter, and that which has been stored for more than 2 years must not be used; S. United States. Perennial lactiferous (when wounded emits milky juice) herb, .3–1 M. (1–3°) high; leaves lanceolate, sessile, serrate; flowers yellow, monœcious; fruit rough round capsule, 3-celled, each cell 1-seeded. Root, terete, unequally tapering, rarely branched, 20–40 Cm. (8–16′) long, .5–3 Cm. ($\frac{1}{5}$–$1\frac{1}{5}$′) thick; usually in cut pieces, 2–5 Cm. ($\frac{4}{5}$–2′) long; reddish-brown, wrinkled, fracture fibrous; internally—bark thick, spongy, fibrous with resin cells, easily separable from porous, radiate wood; odor distinct; taste bitter, acrid, pungent. Powder, pinkish-brown—numerous starch grains with central cleft, fragments with secretion cells bearing resin, tracheæ, wood-fibers, bast-fibers, brownish cork cells, calcium oxalate crystals in rosettes; solvents: boiling water, diluted alcohol; contains sylvacrol (resin), volatile oil 3–4 p. c., glucoside, tannin 10–12 p. c., gum, starch, ash

EUPHORBIACEÆ

5 p. c. Alterative, expectorant, diuretic, diaphoretic, sialagogue, cholagogue, antivenereal; large doses emetic, cathartic, increases heart action, circulation, various secretions; syphilis, scrofula, skin and chronic hepatic affections. Dose, 15–30 gr. (1–2 Gm.); 1. *Fluidextractum Stillingiæ* (diluted alcohol), dose, ♏xv–30 (1–2 cc.): Prep.: 1. *Elixir Corydalis Compositum*, 6 p. c.; 2. *Fluidextractum Stillingiæ Compositum*, 25 p. c., + corydalis 25, blue flag, sambucus, chimaphila, āā 12.5, coriander 6.3, prickly ash berry 6.2, diluted alcohol q. s. 100, dose, ʒss–1 (2–4 cc.): Prep.: 1. *Syrupus Stillingiæ Compositus*, 25 p. c., glycerin 10, syrup 65, dose, ʒj–4 (4–15 cc.). Decoction, 5 p. c., ℥j-2 (30-60 cc.), Extract, gr. 2–5 (.13–.3 Gm.), Tincture 10 p. c., ʒss–2 (2–8 cc.). *Stillingia sebif'era, L. sebum*, tallow, + *ferre*, to bear; China; S. Carolina, Georgia, Florida—sea coast. Tree 6–9 M. (20–30°) high, fruit 3-celled, 3-seeded, imbedded in solid, inodorous fat (palmitin, stearin), melts at 44° C. (112° F.), called China or Vegetable Tallow; used for candles.

Fig. 244.—Stillingia root: magnified 10 diam.

2. *Euphor'bia hir'ta, Euphorbia, Euphorbia Pilulif'era, Pill Bearing Spurge, N.F.*—The dried herb with not more than 5 p. c. of foreign organic matter, nor yielding more than 3 p. c. of acid-insoluble ash; Australia, W. Indies—Tropics, open rich grounds. Pubescent, bristly-hairy, especially upper nodes (dist. from spurious variety), reddish-purple; roots usually present; stems slender, sparsely leafed at base, greenish-brown, rough or hairy; leaves opposite, oblong, serrated, rusty pale green, pubescent on lower surface veins, much broken; flowers numerous, small; fruit 3-celled capsule; seed triangular-ovoid, pale brown; odor aromatic, characteristic; taste faintly bitter, aromatic, acrid. Powder, light yellowish—wood-fibers, wood parenchyma, medullary ray and pith parenchyma with tracheids and tracheæ, pores, markings, cork cells with amorphous content; starch grains, lignified fibers, leaf epidermis with non-glandular hairs; solvents: diluted alcohol, water; contains acrid resin, glucoside, ash 12 p. c. Cardiac and respiratory stimulant; asthma, asthmatic, chronic, subacute bronchitis; may occasion gastric pain, nausea, death. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Euphorbiæ* (diluted alcohol): Prep.: 1. *Elixir*

Euphorbiæ Compositum, Antiasthmatic Elixir, 5.25 p. c., + fldext. lobelia .7, sodium bromide 3.5, sodium iodide 3.5, spirit of glyceryl trinitrate .875, comp. tinct. of cardamom 5, oil of peppermint .1, glycerin 12.5, alcohol 20, dist. water q. s. 100, dose, ʒj–2 (4–8 cc.).

3. *Euphor'bia corolla'ta, Flowering (Blooming) Spurge.*—The root U.S.P. 1820–1870; S. United States. Perennial herb, .6–1 M. (2–3°) high; leaves lanceolate; flowers umbels, 5- (3–7-) forked, white; root many-headed, .5 M. (18′) long, 5–25 Mm. ($\frac{1}{5}$–1′) thick, blackish-brown, fissured, bark thick, white inside, sweet, bitter, acrid; contains glucoside, resin, euphorbon; yields milky juice when punctured. Diaphoretic (gr. 5; .3 Gm.), cathartic (gr. 10; .6 Gm.), emetic (gr. 20; 1.3 Gm.), expectorant (gr. 2–5; .13–.3 Gm.), vesicant; in infusion, decoction.

4. *E. Ipecacuan'hæ, Ipecac Spurge, Wild Ipecac.*—The root, U.S.P. 1820–1870; United States. Plant resembles preceding, being a green or purple perennial, 12.5–25 Cm. (5–10′) high, stem forked from the base; leaves obovate, glabrous; flowers inconspicuous; fruit angled pod, smooth; seed white, dotted; root several-headed, .6 M. (2°) long, knotty, with stem-scars, 10 Mm. ($\frac{2}{5}$′) thick, branched, brown, wrinkled, bark thick, white inside, sweet, bitter, acrid; constituents, properties, and uses similar to preceding.

5. *Heve'a (brasilien'sis* and *H. guianen'sis), Elastica, Rubber.*—The prepared milk-juice, U.S.P. 1890–1900; S. America, east of Andes, India, near streams. Large trees, smooth straight trunks, 15–18 M. (50–60°) high; leaves trifoliate, leaflets obovate, 10 Cm. (4′) long, dark green; flowers racemes. Resin (rubber), in flask-shaped, roundish masses, incised pieces showing laminated structure, lighter than water, brownish-black, internally lighter, mottled, tough, elastic, odor creosote-like, almost tasteless; solvents: chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene; melts at 125° C. (257° F.), soft and adhesive on cooling; heated with sulphur 10 p. c.—vulcanized and insoluble; with 40 p. c.—hard rubber (ebonite). Milk (resembling cow's) exudes from small pick holes, being caught in small cups, emptied into large vessels and conveyed to smoking station, where wooden paddles (lower end) are dipped repeatedly into it (then sometimes into sand—adulteration), and rotated in a column of smoke until coagulated and mass has attained considerable size; contains resin (caoutchouc) 32 p. c., volatile oil, fixed oil. Base of plasters; woven into fabrics to compress and support relaxed muscles and parts; hard rubber in surgical implements—bougies, catheters, pessaries, specula, syringes, etc.

Fig. 245.—Tapioca starch.

6. *Man'ihot Manihot (utilis'sima), Tapioca.* (See pages 90, 91).—The fecula of root (rhizome), U.S.P. 1820–1870; Brazil, W. Indies. Shrub 2–2.5 M. (6–8°) high; stem jointed, petiolate leaves at upper portion, 3–5- to 7-lobed, glaucous.

ANACARDIACEÆ

Root fleshy, white, tuberous, 1 M. (3°) long, weighing 20–30 pounds (9–13 Kg.). Matures in 8 months; contains poisonous (HCN) milky juice; this is pressed out and the cassava meal made into bread or washed for its starch, which is diaphanous, muller-shaped, layers indistinct, hilum near rounded end, only half size of potato starch, which furnishes the factitious tapioca. Nutrient, demulcent, non-irritant; convalescence, debility, asthenic diseases, in doses ʒss–1 (15–30 Gm.), prepared with boiling water, flavored with lemon juice, sugar, vanilla, aromatics, wine, etc.

7. *Ompha'lea oleif'era, Tambor Oil.*—C. America. Expressed from the seed; an excellent purgative, does not gripe like castor oil.

42. ANACARDIACEÆ. Sumac(h) Family.

An-a-kar-di-a'se-e. L. *Anacardi-um* + aceæ, fr. Gr. *ἀνά*, alike, + *χαρδία*, heart—*i. e.*, fruit heart-shaped. Trees or shrubs. Distinguished by abounding in a resinous, gummy, acrid, milky juice; exhalations or juice often poisonous, latter black on drying; ovary 1-celled; styles 1–3 or none; ovules solitary with long funiculus; calyx and corolla regular, 5-lobed, rarely 3–4–7; stamens same number or double the petals. Disk present or wanting; fruit drupe or nut-like, edible; seed exalbuminous, superior; tropics; varnishes, dyes, poisonous.

Genus: **1. Rhus.**

RHUS GLABRA. RHUS GLABRA, *U.S.P.*

Rhus glabra, *Linné.* { The dried ripe fruit with not more than 5 p. c. stems or other foreign organic matter.

Habitat. N. America, west to California, Idaho; on barren or rocky soil.

Syn. Rhus Glab., Sumac Berries, Sumach, Mountain-, Dwarf-, Sleek-, Smooth-, Upland-, Scarlet, or Pennsylvania Sumach, Indian salt (powder on the berries); Fr. Sumach, Sumac; Ger. Sumach.

Rhus'. L. fr. Gr. *ῥοῦς*; Celtic *rhudd*, red—*i. e.*, color of the fruit, also the leaves of the same species in autumn.

Gla'bra. L. fr. *glaber*, smooth, hairless—*i. e.*, its leaves and branches.

Su'mac. L. fr. Ar. *summaq*—*i. e.*, their native name for the plant.

Plant.—Woody shrub 1.5–4.6 M. (5–15°) high; stem more or less bent, dividing into many straggling branches, pith large, wood thin, white; bark smooth, grayish or reddish, with small scattered warts; leaves imparipinnate; leaflets 11–31, lanceolate, acuminate, serrate, whitish beneath, changing to a beautiful red in autumn; flowers June–July, greenish-red, terminal panicles. Fruit, Sept., drupes in small clusters, flattened ovoid, nearly globular, somewhat reniform; 3.5–5.5 Mm. ($\frac{1}{7}$–$\frac{1}{4}$′) long, nearly as broad, usually somewhat less; apex with raised scar, five-parted calyx occasionally with short pedicel at base; dark red, velvety with short hairs; endocarp smooth, shiny, crimson—yellowish-red; 1-locular, 1-seeded; seed brown, very hard; inodorous; taste acidulous, astringent. Powder, brownish-red—

numerous non-glandular hairs, usually several celled, uniseriate, filled with pink or red dried sap, occasionally rod-shaped crystals; few slender 1-celled, colorless, non-glandular hairs; numerous brownish glandular hairs, fragments red-celled epicarp with adhering mesocarp having spiral tracheæ; stone cells of endocarp small, fragments of embryo with cells having aleurone grains and fixed oil. *Solvent:* diluted alcohol. Dose, ʒss–1 (2–4 Gm.).

ADULTERATIONS.—Fruits of allied species—*R. hirta* (*typhina*—shaggy coating of long, straight hair), *R. aromatica* (smaller, less compressed, nearly spherical), *R. Coriaria* (rougher, hispid).

Commercial.—Sumac grows in waste fields, along fences, woods, etc., the bark, galls, and leaves are very astringent, being collected during summer or fall for use in tanning and dyeing, while from these an extract is made containing 25–30 p. c. tannin, and this is its most convenient form for all trade and chemical purposes. For this extract sumac is cultivated in Virginia and other States.

CONSTITUENTS.—FRUIT: Acid calcium and potassium malates, tannin (gallo-tannic acid) 2 p. c., gallic acid, coloring matter. SEED: Fixed oil. GALLS: Tannin 60–70 p. c.

PREPARATIONS.—1. *Fluidextractum Rhois Glabræ.* Fluidextract of Rhus Glabra. (Syn., Fldext. Rhois Glab., Extractum Rhois Glabræ Fluidum, U.S.P. 1890; Fr. Extrait liquide de Sumac; Ger. Flüssiges Sumachextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63—macerate, percolate 100 Gm. with 1st menstruum: glycerin 10 cc., alcohol 50, water 40; finish with 2d: diluted alcohol. Dose, ʒss–1 (2–4 cc.).

Unoff. Preps.: Decoction, 5 p. c., ʒj–2 (30–60 cc.). *Infusion,* 5 p. c., ʒj–2 (30–60 cc.).

PROPERTIES.—Astringent, refrigerant, diuretic; resembles tannin.

USES.—Catarrhal affections of stomach and bowels, pharyngitis, tonsillitis, mercurial aphthæ, spongy gums, and other mouth affections (as a gargle), ulcers, wounds, etc. (as a wash).

Allied Plants:

1. *Rhus aromat'ica, Fragrant* (*Sweet-scented*) *Sumac*(*h*), 1.5–2.5 M. (5–8°) high; given in extract, fluidextract (alcoholic), tincture, and for hematuria, leucorrhea, but mainly for incontinence of urine (enuresis). Dose, gr. 10–30 (.6–2 Gm.). *R. copalli'na, Black, Dwarf, Mountain Sumac*(*h*), 1–2.5 M. (3–8°) high; downy branches; leaflets entire; excels all in yield of tannin. *R. hir'ta* (*typhi'na*), *Staghorn Sumac*(*h*), 4.5–9 M. (15–30°) high; hairy; leaflets serrate. All three indigenous to N. America. *R. Coria'ria, European Sumac*(*h*), Mediterranean Basin; leaflets elliptic, woolly, serrate. *R. semiala'ta* and *R. japon'ica,* China, Japan; these furnish galls which are used in Germany largely for obtaining tannic and gallic acid (see pages 157, 160). The fruits of all these are red, hairy, and acidulous, while the leaves are astringent.

2. *R. rad'icans, Rhus Toxicodendron, Poison Ivy.*—The fresh leaflets, U.S.P. 1870–1890; N. America. Climbing plant over fences, rocks,

ANACARDIACEÆ

trees, etc.; flowers small; fruit smooth drupe. Leaflets, collected May–June, trifoliate, petiolate, entire, glabrous, the 2 lateral nearly sessile, 10 Cm. (4′) long, obliquely ovate and pointed; when dry brittle, inodorous, astringent, when fresh with acrid juice blackening on exposure, applied to skin produces swelling, inflammation, etc. —hence should not handle ungloved or confound with the harmless *Pte'lea trifolia'ta, Three-leaved Hoptree,* whose leaflets are sessile, thicker, paler green; contains toxicodendrol 3.3 p. c., tannin, acetic acid (formerly considered toxicodendric acid); toxicodendrol, the active,

Fig. 246.—*Rhus radicans:* leaf one-half natural size.

irritating, poisonous principle, is a viscid, non-volatile oil (or freed fat acid, or complex glucoside), agreeably odorous, soluble in alcohol, benzene, ether, chloroform, decomposed by heat. Irritant, rubefacient, narcotic, poisonous; internally produces gastro-intestinal inflammation, vertigo, nausea, muscular debility, delirium, mydriasis, convulsions, death. *Poisoning:* The fresh leaves, juice or flying pollen produce external itching, burning, redness, tumefaction, vesication, desquamation, lasting 1–2 weeks. Apply at once soap and water with scrubbing-brush, lead water and laudanum, alkaline solutions (sodium bicarbonate—8 p. c. solution 3–4 times daily, sulphite, chlorinated, thio-

sulphate, diluted ammonia, soapsuds, alum curd), or hot aqueous saturated solution of magnesium sulphate (frequently), or fresh bruised leaves of either fire weed (*Erechtites hieracifolia*), touch-me-not (*Impatiens aurea, biflora*) or burdock (*Arctium Lappa*), or solution of sodium salicylate (2), + fldext. hydrastis (1) + water (5), or tincture or infusion of lobelia, grindelia, or sassafras, cocaine solution 4–8 p. c. (to relieve burning and itching), aristol, glycerite of phenol, opium—no oils, vaselin, alcohol, these being solvents of poison serve to disseminate it, low diet, saline purgatives, quietness. Used in chronic eczema, skin diseases, erysipelas, rheumatism, incontinence of urine, etc. Dose, gr. 2–5–15 (.13–.3–1 Gm.); tincture (fresh leaves bruised and macerated with equal weight of alcohol), ♏ $\frac{1}{10}$–1 (.006–.06 cc.); juice (expressed from leaves and preserved with alcohol) is soluble in ether and possesses all the virtues of the plant; fluidextract, ♏v–30 (.3–2 cc.). *R. Toxicoden'dron*, properly more or less shrubby, .6–1 M. (2–3°) high, erect, leaflets crenately lobed, pubescent, called also Poison Ivy (Oak)—merely a variety of *R. radicans*. *R. diversi'loba*, Pacific coast; leaves with 3–5-lobed, pinnatifid leaflets. *R. Ver'nix (venena'ta)*, Canada, United States, swamps, 3–6 M. (10–20°) high; leaves of 7–13 entire leaflets; fruit yellow; called poison-sumac(h), -dogwood, -elder, and yields most toxicodendrol. *R. pu'mila*, S. Carolina, procumbent shrub; leaves pinnate with 11 toothed acuminate leaflets; fruit red, hairy. All of these are poisonous, but *R. Vernix* the most so, as when in flower it so taints the surrounding air that sensitive persons become poisoned by simple exposure to the effluvium.

3. *Pista'cia Lentis'cus, Mastiche, Mastic, N.F.*—The concrete resinous exudation with not more than 1 p. c. of foreign organic matter; Mediterranean Basin (Spain, France, Italy, Morocco, Greece, etc.), Island of Scio, Grecian Archipelago, etc. Small tree, 3–4.6 M. (10–15°) high, branched, bark smooth, brownish-gray; leaves paripinnate; leaflets 3–5 pairs, lanceolate, entire, mucronate, sessile; flowers small, diœcious; fruit drupe, 6 Mm. ($\frac{1}{4}$′) thick, orange-red. Resin (mastic), subglobular, lenticular pear-shaped tears, 3 Mm. ($\frac{1}{8}$′) broad, pale yellow, greenish-yellow, transparent, glass-like luster, surface sometimes dusty, brittle, plastic when chewed; odor slight balsamic; taste mild, terebinthinate; loses plasticity and deepens in color with age. Secretes in long ducts in the bark from which it is obtained by making longitudinal or transverse incisions in stem and branches, whereupon it slowly exudes, becoming within 2–3 weeks sufficiently hard to be collected carefully in soft-lined baskets. There are two varieties: 1, Separate tears (best, recognized by *N.F.*); 2, Agglutinated tears (allowed to run to the ground, often collected with sand, bark, etc.—inferior); yield 10 pounds (4.5 Kg.), per plant; solvents: chloroform, not less than 97 p. c. in ether, nor less than 80 p. c. in alcohol; contains volatile oil 1–2 p. c., alpha-resin (mastic(h)ic acid) 90 p. c., beta-resin (masticin), soluble in ether, oil of turpentine, bitter principle. Stimulant, diuretic, protective (solution); bronchial, vesical catarrhs, leucorrhea, gastric

debility, chronic diarrhea, toothache (saturated ethereal solution in cavity allowed to harden—temporary filling), masticatory (preserves teeth), fumigation; in alcohol, oil of turpentine as varnish for maps, etc.; seldom used internally. Dose, gr. 15–30 (1–2 Gm.); 1. *Pilulæ Aloes et Mastiches*, ⅔ gr. (.04 Gm.); 2. *Solutio Mastiches Chloroformica Composita*, Pulp Capping Varnish, 30 p. c.; + balsam of Peru 30, chloroform q. s. 100—should be kept in small, well-stoppered bottles.

FIG. 247.—*Pistacia Lentiscus: a*, staminate branch; *b*, pistillate branch; *c*, fruit branch, ¼ nat. size; also flowers, pistil, pollen, fruit, and embryo, enlarged.

4. *Euon'ymus atropurpu'reus*, *Euonymus*, *Wahoo Bark*, *N.F.*—Celastraceæ. The dried bark of the root with not more than 5 p. c. of adhering wood, nor 2 p. c. of other foreign organic matter, yielding not more than 4 p. c. acid-insoluble ash; United States, east of the Mississippi. Ornamental shrub, 1.5–4.6 M. (5–15°) high; wood white; leaves oval, serrate; flowers dark purple cymes; fruit smooth, 4-lobed crimson capsule. Bark, usually transversely curved pieces, occasionally single quills 2–7 Cm. (⅘–3′) long, bark 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{5}$′) thick, light weight, grayish, wrinkled, soft scaly cork, transverse lenticels (fissures); inner surface grayish-white, striate and porous, fracture short with silky fibers of caoutchouc-like substance; odor distinct; taste bitter, acrid. Powder, light brown—starch grains, cork, secretion cells, starch-bearing parenchyma, calcium oxalate rosettes, but no prisms; solvents: hot water, diluted alcohol; contains euonymin, volatile oil 1.3 p. c., resins, atropurpurin, fixed oil, bitter extractive. Laxative, diuretic, tonic, antiperiodic, expectorant; constipation, torpid liver, dropsy, pulmonary affections; overdoses—gastro-intestinal irritant. Owing to its uncertain and irregular absorption, hence toxic (cumulative) action, physicians should watch its tolerance and thereby

regulate its dosage. Dose, ʒss–1 (2–4 Gm.); 1. *Extractum Euonymi* (diluted alcohol), dose, gr. 1–6 (.06–.4 Gm.); 2. *Fluidextractum Euonymi* (diluted alcohol), dose, ʒss–1 (2–4 cc.). Decoction, 5 p. c., Infusion, 5 p. c. each, ʒ j–2 (30–60 cc.); *euonymin* ("Eclectic"), root-bark—brownish; stem-bark—greenish, gr. ½–3–6 (.03–.2–.4 Gm.). *E. americ'nus*, *Strawberry Bush*, low or trailing, with crimson capsules. *E. europæ'us*, common *Spindletree* of hedges, 2.5–6 M. (8–20°) high, cultivated, flowers greenish-yellow, capsules pale red, arillus orange-red; emetic, purgative. Both poisonous to cattle.

FIG. 248.—*Euonymus atropurpureus: a*, outer surface of root-bark; *b*, inner surface of root-bark, nat. size.

5. *Paullin'ia Cupa'na, Guarana, N. F.*—Sapindaceæ. A dried paste consisting chiefly of the crushed seed, yielding not less than 4 p. c. of caffeine; N. and W. Brazil, Guiana, Venezuela. Woody climbing shrub; leaves imparipinnate; flowers yellowish; fruit size of grape, small horse-chestnut, 6-ribbed, splitting into 3 divisions, exposing 3 rounded brownish seed, size of filberts. Paste (guarana), usually cylindrical sticks 3–5 Cm. (1⅕–2′) thick, elliptical cakes, dark reddish-brown, hard, heavy; fracture uneven, often fissured in the center; internally pale reddish-brown, coarsely granular; odor slight; taste slightly astringent, bitter. Powder, light pinkish-brown—parenchyma, altered and unaltered starch grains, sclerenchymatous cells with thick yellowish non-lignified walls. *Test:* 1. Place .001 Gm. on slide, + 1 drop of gold chloride T. S., let stand—crystals of caffeine and gold chloride separate in orthorhombic plates and needles; solvent: 75 p. c. alcohol; contains caffeine (guaranine) 3–5 p. c., tannin 26 p. c., resin, volatile oil, fixed oil, catechin, saponin, starch, gum, ash 2–5 p. c. Nervine, stimulant, tonic, astringent—similar to coffee, tea, maté; produces gayety, restlessness, quick perception, wakefulness; slows pulse, impairs appetite, occasions vesical irritation; nervous sick headache (migraine), such as occurs with menstruation and debauch, attended with bloodshot eyes and throbbing head; diarrhea of phthisis, convalescence, general tonic. Native Indians used powder mixed with cassava or chocolate as food, and the grated (filed—1–2 teaspoonfuls) suspended in cold sweetened water (1 cup) as their habitual exhilarating

ANACARDIACEÆ

yellow beverage, similar to our coffee and tea, which in excess may cause palsy; however, readily controlled by effort. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Guaranæ* (75 p. c. alcohol)—contains 3.6–4.4 p. c. of caffeine, dose, ♏xv–60 (1–4 cc.): Preps.: 1. *Elixir Guaranæ*, 20 p. c., + aromatic elixir 20, comp. elixir of taraxacum q. s. 100; 2. *Elixir*

a *b*

FIG. 249.—*Paullinia Cupana: a*, leafy branch with flowers; *b*, branch with ripe fruit, ½ nat. size; also male and hermaphrodite flowers, pistil, stamens, and fruit, enlarged.

Guaranæ et Apii, 15 p. c., + fldext. celery fruit 15, fldglycer. glycyrrhiz., 3, glycerin 6, elix. aromatic q. s. 100, dose, each, ʒj–3 (4–12 cc.). Extract, gr. 2–5 (.13–.3 Gm.); Infusion, 5 p. c., ℥j–2 (30–60 cc.), Syrup, ʒij–4 (8–15 cc.); Tincture (extract 1, alcohol 30), ʒj–4 (4–15 cc.). *Sapin'dus margina'tus, S. Sapona'ria, Wild China Tree;* S. United States. Fruit, resembling that of azedarach, used as antiperiodic;

fruits of many species of this genus substituted for soap—soap berries—in the tropics.

6. *I'lex verticilla'ta* (*Pri'nos verticilla'tus*), *Prinos, Black Alder, Winter-berry.*—Ilicaceæ (Aquifoliaceæ). The bark, U.S.P. 1820–1880; N. America, swamps; shrub, 2–2.5 M. (6–8°) high; leaves serrate, pubescent beneath; flowers white; fruit scarlet berry, size of pea. Bark thin, fragments 1 Mm. ($\frac{1}{25}'$) thick, brown-ash color, with white patches, black dots and lines; inner surface greenish, striate, bitter, astringent; contains, tannin, resin, bitter principle. Astringent, tonic, alterative, febrifuge, substitute for cinchona; diarrhea, fevers, ulcers, etc. Dose, ʒss–1 (2–4 Gm.); decoction, fluidextract.

7. *I. paraguen'sis* (*paraguayen'sis*), *Maté, Paraguay Tea.*—Brazil. Leaves contain caffeine .2–1.6 p. c., tannin 10–16 p. c., volatile oil, stearoptene, wax, glucoside, proteins 5 p. c., ash 4–8 p. c.

43. RHAMNACEÆ. Buckthorn Family.

Ram-na'se-e. L. *Rhamn-us* + aceæ, Gr. ῥάμνος, the buckthorn, Christ's-thorn, fr. Celtic *ram*, a tuft of branches—*i. e.*, collection of thorns, some species thorny. Trees, shrubs. Distinguished by spiny habit; calyx 4–5-parted; petals and stamens distinct, perigynous, 4–5, opposite each other; sepals valvate; petals involute; ovary 2–5-celled, superior or inferior; fruit dry or fleshy, 2–4-celled, each cell 1-seeded; universal; acrid purgative, bitter tonic, febrifuge, dyes; fruits edible.

Genus: **1. Rhamnus.**

CASCARA SAGRADA. CASCARA SAGRADA, *U.S.P.*

Rhamnus Purshiana, *De Candolle.* { The dried bark, collected at least one year before being used for making medicinal preparations.

Habitat. N. Idaho, west to the Pacific (N. California).

Syn. Casc. Sagr., Rhamnus Purshiana, U. S. P., 1900, Chittem Bark, Sacred-, Persian-, Persiana or Purchiana Bark, Bearberry, Bear (Shittim) Wood; Rhamni Purshiani Cortex.

Rham'nus. L. see etymology, above, of Rhamnaceæ.

Pur-shi-a'na. L. of Pursh, after Frederick Pursh (L. *Purshia*), author of *Flora Americæ Septentrionalis*, 1817.

Cas'ca-ra Sa-gra'da. L. Sp. *cascara*, bark, + *sagrada*, sacred—holy bark—*i. e.*, so considered by many natives, on account of its medicinal properties.

Plant.—Small tree, 4.5–6 M. (15–20°) high; twigs pubescent; leaves 5–15 Cm. (2–6′) long, 2.5–7.5 Cm. (1–3′) wide, thin, elliptic, apex obtuse, base rounded, pubescent beneath, dull green, dentate, petioles short, downy; flowers large, umbellate cymes; fruit drupe, black, obovoid, 8 Mm. ($\frac{1}{3}'$) long, 3-lobed, 3-seeded. Bark, usually flattened, transversely curved pieces, occasionally quills, 1–5 Mm.

($\frac{1}{25}$–$\frac{1}{5}$′) thick; dark brown, brownish-red, longitudinally ridged, grayish or whitish lichen patches, sometimes numerous lenticels, occasionally moss; inner surface longitudinally striate, light yellow, dark reddish-brown, dark brown (old matured bark); fracture short with projections of bast-bundles in inner bark; odor distinct; taste bitter, slightly acrid. POWDER, light brown, olive-brown—broken bast-bundles, crystal-fibers containing calcium oxalate monoclinic prisms; stone cells, more or less adhering; fragments reddish-brown cork; masses of parenchyma and medullary ray cells, red upon addition of alkali; starch grains spheroidal, .003–.008 Mm. ($\frac{1}{8325}$–$\frac{1}{3125}$′) broad. *Tests:* 1. Shake .1 Gm. + hot water (10) occasionally until cold, filtrate + ammonia T. S. (10)—orange-yellow. 2. Macerate .1 Gm. + alcohol (10 drops), boil with water (10 cc.), cool, filter; shake filtrate + ether (10 cc.)—yellow ethereal layer separates; of this shake 3 cc. + ammonia T.S. 3 cc.—separated ammoniacal solution + water (20 cc.)—retains distinct yellowish-red. *Solvent:* diluted alcohol. **Dose, gr. 15–60 (1–4 Gm.).**

FIG. 250.—*Rhamnus Purshiana* (Cascara Sagrada): *A*, *B*, flowering branches; *1*, flower cluster; *2*, flower, vertical section, magnified; *3*, fruit.

ADULTERATIONS.—Barks of allied species: Formerly the smaller quills of *R. californica*, with medullary rays irregularly curved and grouped; in powder often find *R. Frangula*, which, owing to absence of stone cells and its longer bast-fibers, may be recognized; to this latter ammonia imparts deeper color.

Commercial.—Obtain bark in the spring from young trunks and large branches, dry carefully; should not be taken from old trunks, as that

has different taste and characteristics. The emetic action of green bark is due to a hydrolytic ferment, which is destroyed either by aging or moderately heating (38° C.; 100° F.) for 48 hours.

CONSTITUENTS.—Emodin (non-laxative), isoemodin, resin, tannin 2 p. c., glucose, volatile oil (yellowish-green, odorous), fixed oil (rhamnol arachidate, glycerides of linolic and myristic acids) 2 p. c., rhamnol (alcohol identical with quebrachol), $C_{20}H_{34}O$, hydrolytic ferment (non-griping), syringic acid (not preëxisting in the bark, but from a substance of unknown nature by the action of acids), ash 6–8 p. c. The active principle, undetermined chemically, but possibly a glucosidal derivative, is obtained by precipitating aqueous solution of the alcoholic extract with lead subacetate, treating precipitate with ethyl-acetate, thereby yielding a non-crystalline, sticky mass containing laxative constituent. The "cascarin" and "purshianin" of previous investigators are regarded now simply as emodin with impurities, these latter constituting the medicinal entity, as purshianin gr. $\frac{1}{5}$ (.013 Gm.) is purgative. The constituents of fresh (1-year) and matured (3-year) bark seem not to differ.

PREPARATIONS.—1. *Extractum Cascaræ Sagradæ.* Extract of Cascara Sagrada. (Syn., Ext. Casc. Sagr., Extract of Rhamnus Purshiana, Powdered Extract of Cascara Sagrada; Br. Extractum Cascaræ Sagradæ Siccum; Fr. Extrait de Cascara Sagrada; Ger. Amerikanisch Faulbaumrindenextrakt.)

Manufacture: Macerate 3 hours 90 Gm. with boiling water 400 cc., percolate until exhausted (500 cc.), evaporate to dryness, pulverize, add dried starch q. s. 30 Gm. (to preserve powdered condition); mix powders thoroughly, pass through fine sieve and transfer it to small, wide-mouthed bottles and stopper them tightly. Dose, gr. 2–8 (.13–.5 Gm.).

2. *Fluidextractum Cascaræ Sagradæ.* Fluidextract of Cascara Sagrada. (Syn., Fldext. Casc. Sagr., Fluidextract of Rhamnus Purshiana; Br. Extractum Cascaræ Sagradæ Liquidum; Fr. Extrait fluide de Cascara Sagrada; Ger. Cascara Sagradafluidextrakt.)

Manufacture: Similar to Fluidextractum Glycyrrhizæ, page 317; evaporate to 75 cc., cool, add gradually alcohol 25 cc., and, if necessary, water q. s. 100 cc. Dose, ♏x–30 (.6–2 cc.).

3. *Fluidextractum Cascaræ Sagradæ Aromaticum.* Aromatic Fluidextract of Cascara Sagrada. (Syn., Fldext. Casc. Sagr. Arom., Aromatic (Tasteless) Fluidextract of Rhamnus Purshiana; Fr. Extrait fluide aromatique de Cascara Sagrada; Ger. Bitterloses Cascara Sagradafluidextrakt.)

Manufacture: Slake lime 6 Gm. with water q. s., mix it with cascara sagrada 100 Gm. + magnesium oxide 6 Gm. (to remove bitterness), moisten uniformly with boiling water 200 cc., macerate in shallow dish for 48 hours, percolate with boiling water until exhausted, evaporate to 50 cc.; while warm dissolve in it pure extract of glycyrrhiza 4 Gm., cool, add glycerin 20 cc., alcohol 20 cc. in which have been

dissolved gluside .1 Gm., oil of anise .25 cc., oil of cinnamon .02 cc., oil of coriander .01 cc., methyl salicylate .02 cc., and water q. s. 100 cc. Here the magnesium oxide forms with the bitter principle (acid resin) a magnesium salt, insoluble in the menstruum, while the oxymethylanthraquinone is soluble. Dose, ♏x–30 (.6–2 cc.).

Preps.: 1. *Elixir Cascaræ Sagradæ, N.F.*, 50 p. c., + elix. glycyrrh. aq. 50. 2. *Elixir Cascaræ Sagradæ Compositum, N.F.*, 12.5 p. c., + fldext. senn. 7.5, fldext. jugland. 6.5, elix. arom. q. s. 100. Dose, each, ʒj–2 (4–8 cc.).

4. *Fluidglyceratum Cascaræ Sagradæ, N.F.*, 100 p. c. Dose, ♏xv–30 (1–2 cc.). 5. *Fluidglyceratum Cascaræ Sagradæ Aromaticum, N.F.*, 75 p. c., + fldglycer. glycyrrhiz. 25, lime 2, mag. oxid. pond. 2, +. Dose, ♏xv–30 (1–2 cc.).

Unoff. Preps.: Aromatic Syrup of Cascara (Br.), 40 p. c., ʒss–2 (2–8 cc.), *Cordial*, ʒj–2 (4–8 cc.), *Tincture*, 15 p. c., ʒss–2 (2–8 cc.).

Fig. 251.—*Rhamnus Purshiana:* transverse section, magnified 10 diam.

Properties.—Purgative, tonic, febrifuge, increases secretions of stomach, liver, pancreas; not usually given as a single cathartic, but where frequent repetition is required; it operates in 6–10 hours, and wears well, as generally increased quantities are not needed when habitually used; it regulates action of the bowels, and acts best when given on empty stomach in concentrated form. Fresh bark nauseates and gripes, owing to a ferment which in time changes, so that matured official bark and its preparations should be without these properties. The purgative action is claimed by some to be due largely to resins, tonic to bitter principle.

Uses.—Habitual constipation due to torpor of the colon, dyspepsia, hemorrhoids.

Allied Plants:

1. *Rhamnus Frang'ula, Frangula, Buckthorn Bark, N.F.*—The dried bark with not more than 2 p. c. of foreign organic matter; Europe, N. Asia—hedges. Slender straggling bush, 3–4.5 M. (10–15°) high, non-thorny; leaves oval, entire; flowers whitish; fruit (berry) size of a pea; green, white, yellow, pink, red, finally black; 2–3-seeded. Bark, varying length quills, frequently flattened, crushed, .5–1 Mm. ($\frac{1}{50}$—$\frac{1}{25}$′) thick, purplish-black, numerous light-colored transverse lenticels, occasional lichens; inner surface smooth, brownish, purplish blotches, striate—red with solution of alkalies; fracture short, inner layer fibrous; odor distinctive; taste slightly bitter. Powder, yellowish-brown—cork and parenchyma tissue, calcium oxalate rosettes, bast-fibers with yellowish lignified walls, crystal-fibers with calcium oxalate prismatic crystals, starch grains; no stone cells (dist. from *R. Purshiana*); solvent: diluted alcohol; contains frangulin, $C_{21}H_{20}O_9$ (rhamnoxanthin) .04 p. c.—by hydrolysis yields emodin and rhamnose, $C_6H_{12}O_5$, while

emodin, $C_{15}H_{10}O_5$, + rhamnose = frangulin + water; also emodin 1–3.8 p. c., isoemodin, frangulic acid, chrysophan, resin, tannin, ash 5–6 p. c. Purgative, tonic, diuretic—when fresh emetic, severe intestinal irritant causing much pain, when modified by age resembles rhubarb, senna, although milder; dropsy, costiveness, constipation of pregnancy (fldext. ♏xx (1.3 cc.) ter die); parasitic skin affection—itch, etc. (ointment of fresh bark). Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Frangulæ* (exhaust with boiling water, add one-fourth alcohol —preservative), dose, ʒss–1 (2–4 cc.): Prep.: 1. *Elixir Catharticum Compositum*, 12.5 p. c., + fldext. senn. 10, fldext. rhei 6.2, liq. pot. hydrox. .45, sp. menth. pip. 1.4, elix. arom. q. s. 100, dose, ʒj–4 (4–15 cc.). Decoction, 5 p. c., ʒss–1 (15–30 cc.); Extract, gr. 2–8 (.13–.5 Gm.).

Fig. 252.—*Rhamnus Frangula:* bark, natural size.

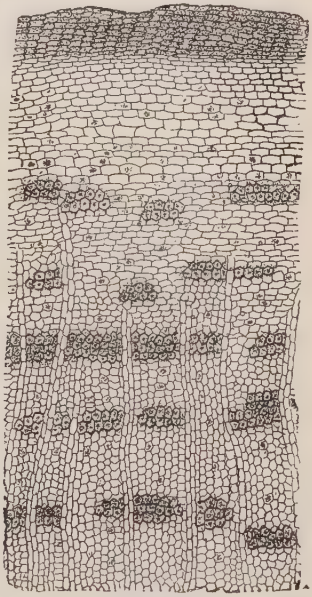


Fig. 253.—Frangula bark: transverse section, magnified 80 diam.

2. *R. cathar'tica, Buckthorn Berries, Baccæ Spinæ Cervinæ, N.F.*—The dried ripe fruit with not more than 5 p. c. of unripe fruit or other foreign organic matter; Europe, N. Asia—naturalized in N. America. Small tree 3–4.5 M. (10–15°) high, short branches, thorny; leaves 2.5–5 Cm. (1–2′) long, 2.5 Cm. (1′) broad; flowers greenish. Fruit, Sept., size of a pea, flattened, globoid, 4–8 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) broad, purplish-black, wrinkled, 3–4-celled, each cell with a brown seed-like nutlet—pedicel lacking; odor faint, unpleasant; taste sweetish, then nauseating, bitter; colors saliva—purplish-red; unripe fruit—discarded, greenish-brown, firm, furrowed, pedicel attached, very bitter. Powder, dark

brown—epidermal cells, parenchyma—some with an amorphous substance, calcium oxalate rosettes, sarcocarp cells, some with yellow oily content; stone cells, calcium oxalate prisms, fixed oil, aleurone grains; solvent: diluted alcohol; contains emodin-autranol, gesterin, rhamno-

FIG. 254.—*Rhamnus cathartica:* 1–3, the imperfect pistillate and staminate flowers; 2, stamens—*s*, fertile, *a*, sterile; 4, *f*, fruit; *g*, cross-section of fruit.

cathartin (a glucoside of emodin)—emodin, rhamnonigrin, resin (containing emodin), rhamnose, glucose, fixed oil, quercetin and rhamnin (yellow coloring matter), ash 5 p. c. Cathartic—similar to cascara sagrada; chiefly in veterinary practice. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Rhamni Catharticæ* (diluted alcohol), dose, ʒss–1 (2–4 cc.): Prep.: 1. *Syrupus Rhamni Catharticæ,* 20 p. c., + ol. fœnic., $\frac{1}{5\,0}$, ol. cinnam. $\frac{1}{5\,0}$, syrup q. s. 100, dose, ʒj–3 (4–12 cc.). Decoction, 5 p. c.—expressed juice made into syrup. Fresh juice with alum or lime yields the pigment—*sap green.* *R. carolinia'na, Carolina* (*Southern*) *Buckthorn,* New York-Texas, is a shrub or small tree; leaves oblong, serrate; flowers short-peduncled; fruit purple, 3-seeded.

FIG. 255.—*Vitis vinifera:* in fruit.

3. *Vi'tis vinif'era, Grape Vine.*—Vitaceæ. The fermented juice(white wine, red wine) of fresh fruit, U.S.P. 1820–1900; W. Asia, cultivated universally. Climbing perennial shrub; stem woody, brownish, long, tortuous; leaves 5–10 Cm. (2–4′) long, 5-lobed, roundish, cordate; flowers greenish; fruit ovoid berry, 12–25 Mm. ($\frac{1}{2}$–1′) broad, pericarp thin, green, yellow, purple, red; pulp juicy, greenish, sweet, acidulous; seed few, pyriform; grapes contain sugar 12–30 p. c., potassium bitartrate, calcium tartrate, calcium phosphate, potassium sulphate, sodium chloride, tannic acid, malic acid, albumin, pectin, etc.; argol—potassium bitartrate, tartaric acid. 1. Vinum Album, White Wine.

Obtained by fermenting for several weeks the juice of fresh grapes freed from seeds, stems, skins; contains 7–12 (8.5–15 vol.) p. c. of alcohol, and includes Sherry, Lisbon, Teneriffe, Madeira, Rhenish, Hock, Moselle, French, California, etc. 2. Vinum Rubrum, Red Wine. Obtained by fermenting juice of fresh grapes in the presence of their skins; contains 7–12 (8.5–15 vol.) p. c. of alcohol, and includes Claret, Port, Burgundy, etc. Stimulant, depressant, astringent, tonic, diaphoretic; fevers, general debility, irritable stomach, ulceration, gangrene, tetanus, old age.

44. MALVACEÆ. Mallow Family.

Mal-va'se-e. L. *Malv-a* + aceæ, fem. pl. of *malvaceus*, of mallows; *malva*, mallow, fr. Gr. μαλακός, soft, mild—*i. e.*, owing to its emollient properties or soft, downy leaves. Herbs, shrubs, trees. Distinguished by stamens monadelphous, anthers 1–celled, seed reniform; flowers regular; sepals 5; petals 5; pistils several, united; albuminous, superior; temperate climate, tropics; demulcent, tough fibers, hairs as cotton.

Genera: **1. Althæa. 2. Gossypium.**

ALTHÆA. ALTHEA, *U.S.P.*

Althæa officinalis, *Linné.* { The dried root deprived of the brown, corky layer and small roots.

Habitat. Europe, Western and Northern Asia; naturalized in salt marshes, New England, New York, Australia; cultivated in Europe.

Syn. Marsh Mallow Root, Marsh Mallow, White Mallow, Mortification Root, Sweetweed, Wymote; Fr. Racine de Guimauve, Guimauve; Ger. Radix Althææ, Eibischwurzel, Eibisch.

Al-thæ'a. L. fr. Gr. ἀλθαίνω, to heal, cure—*i. e.*, its medicinal qualities (Dioscorides).

Of-fi-ci-na'lis. L. see (*Smilax*) *officinalis*, page 122.

Plant.—Perennial herb .6–1.3 M. (2–4°) high, having several woolly stems; flowers large, 2.5–5 Cm. (1–2′) in diameter, purple. Root, slenderly tapering, 15–30 Cm. (6–12′) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) thick; usually cut into small pieces, 5 Mm. ($\frac{1}{5}$′) thick, whitish, longitudinally furrowed, frequently spirally twisted and covered with somewhat loosened bast-fibers (hairy); fracture fibrous (bark), short, granular (wood); internally yellowish-white; bark 1–2 Mm. ($\frac{1}{25}$—$\frac{1}{12}$′) thick, porous (due to mucilage cells) and separated from slightly radiating wood by grayish cambium zone; odor slight; taste sweetish, mucilaginous. Powder, whitish—many starch grains up to .03 Mm. ($\frac{1}{833}$′) in diameter, usually with long central cleft; groups of fibers with thick, more or less lignified walls; tracheæ, scalariform thickenings or bordered pores, few calcium oxalate crystals in rosette aggregates. *Tests:* 1. Macerate 1 Gm. for 30 minutes in water 10 cc., stirring occasionally, filter through purified cotton—pale yellow, neutral mucilage, + a few

drops of sodium hydroxide T. S.—turns deep yellow; mucilage does not have a sour or ammoniacal odor. Leaves (Althææ Folia, Marsh Mallow Leaves, *N. F.*). The dried leaves with not more than 5 p. c. stems and fruits or other foreign organic matter. Crumpled or matted, gray-green, densely and finely tomentose, petioles 1–6 Cm. ($\frac{2}{5}$–$2\frac{2}{5}'$) long; blades 3–15 Cm. ($1\frac{1}{5}$–$6'$) long, 3–10 Cm. ($1\frac{1}{5}$–$4'$) broad, thin, cordate, rounded at base, acute, doubly serrate-dentate, lobed, 2–6 principal veins from midrib in the petiole; odor slight, scarcely characteristic; taste mucilaginous. Powder, grayish-green—stellate and glandular hairs, calcium oxalate in rosette aggregates, stomata, mucilage cells, pollen grains. *Solvents:* water—cold, dissolving asparagin, mucilage, sugar; hot, also starch. Dose, ʒss–1 (2–4 Gm.).

Fig. 256.—*Althæa officinalis.*

Adulterations. — Root: Belladonna root, when young and peeled, resembles althea, but distinguished by absence of hair-like bast-fibers, and by possessing visible yellowish wood bundles; old dark-colored althea roots sometimes are whitened with calcium oxide or sulphate, which subside to the bottom upon soaking in water, thereby readily being detected; root sometimes marketed cut in small cubes, rendering admixtures more likely; Powder: Starchy substances recognized by shape of starch granules.

Commercial.—Plant during first 2 years produces only a tap-root, which soon therafter becomes tough, woody, inert, and much branched, the branches having little medicinal value; the unscraped root is yellowish-brown, nonfibrous, and should be collected (late autumn) from cultivated plants, peeled, and dried carefully; leaves and flowers sometimes used.

Constituents.—Root: Asparagin (althein, amido (-succinamide) -succinic acid, asparamide) 1–2 p. c., Mucilage (bassorin, althea mucilage, upon which value depends) 35 p. c., Starch 37 p. c., pectin 11 p. c., betaine, sugar 11 p. c., fat 1.25 p. c., ash 4–8 p. c. Leaves: similar but less mucilage.

Asparagin, $C_4H_8O_3N_2.H_2O$.—Obtained by putting the thick, viscid, mucilage of althea into a dialyzer, with water outside; asparagin passes into the water, which upon evaporation yields the crystals. These are colorless, neutral, transparent, lustrous, sp. gr. 1.520, soluble in water (47), acids, alkalies, converted by these latter into ammonia and aspartic acid; therapeutically inactive. Dose, gr. 5–10 (.3–.6 Gm.).

PREPARATIONS.—ROOT: 1. *Massa Hydrargyri*, 15 p. c. 2. *Pilulæ Ferri Carbonatis*, $\frac{1}{6}$ gr. (.01 Gm.). 3. *Pilulæ Phosphori*, 1 gr. (.06 Gm.). 4. *Syrupus Althææ, N.F.*, 5 p. c., + alcohol 3, glycerin 10, sucrose 70, water q. s. 100. Dose, ʒj–4 (4–15 cc.). 5. *Species Pectorales, Breast Tea, N.F.*, 40 p. c., + coltsfoot 20, glycyrrhiza 15, anise, mullein

FIG. 257.—*Althæa officinalis: 1*, expanded flower; *2*, vertical section of flower; *3*, stamen; *4*, stamen after discharge of pollen; *5*, fruit; *6*, outside calyx as seen from beneath.

flowers, āā 10, orris 5. LEAVES: 1. *Species Emollientes, Emollient Cataplasm, N.F.*, 20 p. c.—althea leaves, mallow leaves, melilot, matricaria, linseed, āā 20 Gm., hot water q. s. 100. Poultice.

Unoff. Preps.: Decoction, Infusion, each, 5 p. c., ʒj–4 (30–120 cc.). Ointment.

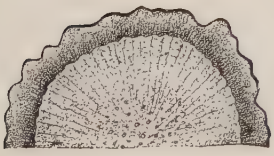


FIG. 258.—Althæa: transverse section, magnified 2 diam.

FIG. 259.—*Malva sylvestris:* showing flowers, leaves, and fruit.

PROPERTIES.—ROOT and LEAVES: Demulcent, emollient, protective.

USES.—Inflammations of pulmonary, digestive, and urinary organs, mucous membranes; skin eruptions, herpes, psoriasis, enema (decoction) for vaginal and rectal irritation. In pharmacy, the powdered root being very absorbent, is used to harden pills, troches, electuaries, etc. *A. ro'sea, Hollyhock.*—Levant, formerly cultivated in gardens for flowers (petals—*Flores Malvæ Arboreæ*), 7.5–12.5 Cm. (3–5′) broad, nearly sessile, composed of tomentose calyx and 5 purple petals.

MALVACEÆ

Allied Plants:

1. *Mal'va sylves'tris* and *M. rotundifo'lia, Malvæ Folia,* (*High* and *Low*) *Mallow Leaves, N. F.*—The dried leaves with not more than 10 p. c. of other parts of the plants, nor 5 p. c. of foreign organic matter; Europe, Asia, cultivated in United States. Biennials—former erect, 1 M. (3°) high, latter procumbent, spreading; flowers reddish-purple, bluish; with ammonia—green, with acids— red. Leaves (*M. sylvestris*), orbicular, reniform, cordate, 10–11 Cm. (4–4⅖′) long, 15–20 Cm. (6–8′) broad, 3–7-lobed, petioles up to 10 Cm. (4′) in length, palmate, crenate-dentate, pubescent; (*M. rotundifolia*), orbicular, up to 8 Cm. (3⅕′) broad, cordate, 5–7-lobed, palmate, teeth blunt, less pubescent, petioles up to 20 Cm. (8′) in length; inodorous, taste bland, mucilaginous—on chewing. Powder, light green—non-glandular hairs, stomata, pith and spongy parenchyma, stem fibers, tracheæ, mucilage cells, calcium oxalate rosette crystals; solvent: water; contains mucilage, pectin, tannin, ash 16 p. c. Demulcent, emollient; dysentery, catarrh, kidney troubles. Dose, ʒss–1 (2–4 Gm.); 1. *Species Emollientes,* 20 p. c. *Abu'tilon* and *Hibis'cus* species possess similar medicinal properties and may be used satisfactorily one for the other.

GOSSYPIUM. COTTON.

1. Gossypium Purificatum. Purified Cotton, *U.S.P.*
2. Oleum Gossypii Seminis. Cottonseed oil, *U.S.P.*

Gossypium herbaceum, *Linné,* or other species. { 1. The hairs of the seed of cultivated varieties, freed from adhering impurities and linters, and deprived of fatty matter. 2. The refined fixed oil from the seeds of cultivated varieties.

Habitat. C. Asia, India, China, Arabia, N. E. Africa, Egypt; cultivated in United States, W. Indies, C. and S. America, N. Africa, Australia, Spain.

Syn. 1. Gossyp. Purif., Absorbent Cotton, Gossypium, Cotton, Cotton Wool; Fr. Coton; Ger. Gossypium depuratum, Gereinigte Baumwolle. 2. Ol. Gossyp. Sem., Cotton Seed Oil; Fr. Huile (de Coton) de Semences de Cotonnier; Ger. Baumwollsamenöl.

Gos-syp'i-um. L. fr. Ar. *Goz, Gothn,* a soft, silky substance—*i. e.,* the hairs of the seeds.

Her-ba'ce-um. L. *herbaceus,* grassy, herby—*i. e.,* the plant habit.

Plant.—Small biennial or triennial shrub; stem branching, 1.5–3 M. (5–10°) high, more or less woody; leaves hoary, palmately 3–5-lobed; flowers large, 5–7.5 Cm. (2–3′) long and wide, yellow, purple spot near the claw; fruit capsule or boll 4–5 Cm. (1⅗–2′) long, 3–5-celled, opening by as many valves when ripe, revealing loose, white tuft of long, slender hair that surrounds each one of the numerous seeds. Hairs of the Seed, in white, soft, fine filaments, 12–37.5 Mm.

(½–1½′) long; under microscope hollow, flattened, twisted bands, spirally striate, slightly thickened edges; odorless; almost tasteless; insoluble in ordinary solvents. *Tests:* 1. Compress in the hand, throw upon cold water—readily absorbs latter and sinks. 2. Incinerate 5 Gm.—ash .2 p. c. 3. Thoroughly saturate 10 Gm. with water 100 cc., with glass rod press out 2 separate portions, 25 cc. each; first portion, + 3 drops of phenolphthalein T. S.—no pink color (abs. of alkali); second portion, + 1 drop of methyl orange T. S.—no pink color (abs. of acid). 4. Exhaust 10 Gm. with ether q. s. 200 cc., evaporate to dryness—residue not over .6 p. c. (abs. of fatty matter). 5. Extract 10 Gm. with alcohol q. s. 50 cc.; observed downward through a column 20 Cm. in depth—may show yellowish color, but no blue or green (abs. of dyes). *Impurities:* Alkali, acid, fatty matter, dyes, water-soluble substances. *Solvent:* Ammoniated cupric oxide T. S. OIL OF THE SEEDS, a pale yellow, oily liquid, odorless, nearly odorless, bland taste, slightly soluble in alcohol; miscible with ether, chloroform, petroleum benzin, carbon disulphide, sp. gr. 0.918; on cooling below 12° C. (54° F.) particles of solid fat separate, and at —5 C. (23° F.) nearly or quite a solid. *Tests:* 1. Oil and carbon disulphide equal volumes + sulphuric acid (sp. gr. 1.6–1.7)—reddish-brown color rapidly produced. 2. Mix 2 cc. with 2 cc. of a mixture of equal vols. amyl alcohol and a 1 p. c. solution of precipitated sulphur in carbon disulphide, and immerse to one-third depth in boiling saturated aqueous solution of sodium chloride—red color in 10–15 minutes. Dose, ʒij–8 (8–30 cc.).

SUBSTITUTIONS.—I. HAIRS: *Bœhme′ria ni′vea*, fiber may be used for cotton, lint, etc. II. OIL: 1, Brazil or Para Nut Oil; nuts 2.5–5 Cm. (1–2′) long, 3-edged, brownish-gray kernel, white, almond taste; yield 60 p. c. oil; 2, Oleum Fagi, Beech Oil, from fruit of *Fa′gus sylvat′ica*, kernels yield 22 p. c. oil; yellow, sp. gr. 0.922, congeals at —17.5° C. (0° F.).

Commercial.—Cotton was known to the Arabians, Egyptians, and Chinese in the 10th century, and was carried to Spain by the Moors in the 16th century. The ancient Egyptians possibly were unacquainted with it, as their mummy fibers are all linen, and no seeds or paintings of plants are found in the tombs. However, in Peru mummy clothing from earliest date contain cotton, consequently here may be its original habitat. Many species now give similar products, but our own is thought to be from *G. barbadense*, Barbados Islands, W. Indies. Chapman refers long-staple or Sea Island cotton, which we cultivate, to *G. ni′grum*, and short-staple or Upland cotton to *G. al′bum*. The hairs are removed by hand or mill (cotton gin) from the seeds, and owing to the latter containing fixed oil, 15–20 p. c., a portion of it becomes absorbed by the attached fiber and must be eliminated before adapted for general use. Purification is effected by boiling carded cotton in 5 p. c. solution of potassium or sodium hydroxide, washing with water to remove soap, expressing, adding 5 p. c. solution of chlorinated lime, allowing to stand half an hour, washing, expressing, adding acidulated

(HCl 5 p. c.) water, washing, expressing—a process that may be repeated if necessary, removing 7–10 p. c. of weight, chiefly fat. The oil is obtained by cracking off testa, grinding and expressing kernels; at first it is thick, reddish-brown, turbid from albumen and mucilage, which mostly subside on standing, yielding orange-colored *clarified oil;* when this is treated with boiling water or superheated steam albuminoids are coagulated, giving lighter colored *refined oil*, which upon being bleached (agitated with alkaline solution and heated) yields *winter-bleached oil;* the loss in refining is 5–10 p. c., and as such is official. It is exported extensively for olive oil adulteration, for which demand a line of tanked steamers ply regularly between New Orleans and Europe, each having a capacity of 500,000–1,000,000 gallons; 12,000–20,000 barrels (1894–3788 Kl.).

Fig. 260.—*Gossypium herbaceum: a*, outside calyx; *f*, fruit.

Fig. 261.—*Gossypium herbaceum:* cotton fiber, magnified 250 diam.

Constituents.—I. Hairs: Cellulose $(C_6H_{10}O_5)_x$, inorganics 1.5 p. c., fixed oil 7–10 p. c. II. Oil: Olein, palmitin, linolein, glyceride of linoleic acid, and non-saponifiable yellow coloring matter.

Preparations.—I. Hairs: 1. *Pyroxylinum.* Pyroxylin. (Syn., Pyroxylin, Soluble Gun Cotton, Colloxylin, Collodion Cotton, Lana Collodii; Fr. Fulmicoton soluble; Ger. Kollodiumwolle.)

Manufacture: Macerate purified cotton in a cooled mixture of 14 vols. of nitric acid and 22 vols. of sulphuric acid until the cotton is soluble in a mixture of 1 vol. of alcohol and 3 vols. of ether, remove adhering acid by washing first with cold, then boiling water, dry in small portions at 60° C. (140° F.). It is a yellowish-white matted mass of filaments, resembling raw cotton in appearance, harsh to the touch, exceedingly inflammable, burning, when unconfined, very rapidly with luminous flame, less explosive than cellulose hexanitrate; kept in well-closed bottles exposed to light, decomposes with evolution of nitrous vapors, and carbonaceous residue; consists chiefly of cellulose tetranitrate, $C_{12}H_{16}O_6(NO_3)_4$. *Tests:* 1. Soluble slowly but completely

in 25 parts of a mixture of 1 vol. of alcohol and 3 vols. of ether; soluble in acetone, glacial acetic acid, and precipitated from these solutions on the addition of water. 2. Saturate .5 Gm. with alcohol in a dish in cold water, ignite from top; when combustion complete, heat dish to redness—ash .3 p. c. 3. Stir 1 Gm. + water 20 cc. for 10 minutes, filter—filtrate shows no acid reaction; 10 cc. evaporated to dryness on water-bath—residue not more than .0015 Gm. (abs. of soluble substances). Should be kept dark, dry, in cartons packed loosely.

Prep.: 1. *Collodion.* Collodion. (Syn., Collod.; Fr. Collodion; Ger. Collodium, Kollodium.)

Manufacture: Add alcohol 25 cc. to pyroxylin 4 Gm., shake, add ether 75 cc., shake until dissolved; cork well, set aside until clear, decant from any sediment. It is a clear, slightly opalescent, syrupy liquid; colorless, slightly yellowish; odor of ether; highly inflammable, and when exposed in thin layer leaves a transparent, tenacious film; sp. gr. 0.770; mixed with equal volume of distilled water a viscid, stringy mass (pyroxylin) separates; aqueous liquid not acid. Should be kept cool, remote from fire, in well-closed containers.

Prep.: 1. *Collodium Flexile.* Flexible Collodion. (Syn., Collod. Flex.; Fr. Collodion élastique; Ger. Collodium elasticum, Elastisches Kollodium.)

Manufacture: Shake in a tared bottle collodion 95 Gm., castor oil 3, camphor 2, until latter dissolved. Should be kept cool, remote from fire, in well-closed containers.

Preps.: 1. *Collodium Bituminis Sulphonati, N.F.*, 90 p. c. 2. *Collodium Salicylicum Compositum, N.F.*, 90 p. c. 3. *Collodium Stypticum, N.F.*, 90 p. c.; each should be kept cool, in tightly-stoppered bottles.

2. *Gossypium Stypticum, N.F.*—macerate 100 Gm. for 1 hour in solution of ferric chloride 80 cc., glycerin 16, water 225, press until it weighs 300 Gm., dry; keep in well-closed glass containers. II. Oil: 1. *Linimentum Camphoræ*, 80 p. c. 2. *Ampullæ Camphoræ, N.F.*, q. s. 3. *Unguentum Picis Compositum, N.F.*, 34 p. c.

Unoff. Preps.: I. Hairs: *Medicated Cottons* (borated, benzoinated, chlorinated, phenolated (carbolated), salicylated, iodoform, mercuric (bi)chloride, hemostatic, etc.); *Iodine Collodion*, 5 p. c.; *Iodoform Collodion*, 5 p. c., *Croton Oil Collodion*, 10 p. c. II. Seed: *Cottonseed Tea* (mucilaginous drink for dysentery, diarrhea, etc.).

Properties.—I. Hairs: Protective. II. Oil: Demulcent, nutrient.

Uses.—I. Hairs: Dressing in burns, scalds, erysipelas, blisters, surgical wounds; prevents entrance of organic germs that cause suppuration and septic disease. Cotton batting maintains local heat in pneumonia, rheumatism, and may be made into pessaries. II. Oil: Like olive and almond oils in pharmacy, liniments, etc., in culinary use for lard; to adulterate olive oil, in preparing woollen cloth, morocco leather, lubricating machinery, etc.

STERCULIACEÆ

Derivative Product:

1. *Gossypii (Radicis) Cortex, Cotton Root Bark, N. F.*—The recently gathered air-dried bark of the root of one or more cultivated varieties with not more than 5 p. c. of wood or other foreign organic matter. Root-bark, in flexible bands, quilled pieces, up to 30 Cm. (12′) in length, 1 Mm. ($\frac{1}{25}$′) thick, orange-brown, smooth, usually finely wrinkled, fissured, roughened from exfoliation of corky layers, fuzzy; inner surface light brown, striate; fracture tough, fibrous, separable into fibrous layers; odor slight; taste slightly acrid. Powder, brownish—numerous bast-fibers, cortical parenchyma, starch grains, secretory reservoirs, medullary ray cells, calcium oxalate rosette crystals; solvents: diluted alcohol, boiling water; contains resin (acrid, colorless, soluble in water, becoming red on exposure and insoluble) 8 p. c., fixed oil, tannin, starch, ash 7 p. c. Emmenagogue, oxytocic, uterine hemostatic, similar to ergot, but less reliable; dysmenorrhea, amenorrhea, uterine tumors and hemorrhages—popular among negroes (who brought it from Africa) in Southern States for inducing abortion. Dose, ʒss 1 (2–4 Gm.); 1. *Fluidextractum Gossypii Corticis* (alcohol), dose, ʒss–1 (2–4 cc.). Decoction—ʒiv (120 Gm.) + water Oij (900 cc.), evaporated to Oj (450 cc.), ʒij (60 cc.), every half hour. *G. barbaden'se, G. arbo'reum, G. religio'sum* (fibers yellow), etc., furnish products which may be used similarly to the official.

45. STERCULIACEÆ. Silk Cotton Family.

Ster-ku-li-a′se-e. L. *Sterculi-a* + aceæ, from *stercus*, excrement, *Sterculius*—God of—*i. e.*, named from the fetid flowers or fruit of certain species. Trees, shrubs. Distinguished from Malvaceæ by anthers 2-celled and flowers sometimes unisexual by abortion; calyx 5, corolla 5, twisted; tropics, temperate climates; demulcent, emetic, purgative.

Genus: **1. Theobroma.**

THEOBROMA. CACAO (Chocolate Tree).

Oleum Theobromatis. Oil of Theobroma, *U.S.P.*

Theobroma Cacao, *Linné.* } The fat obtained from the roasted seeds.

Habitat. S. America (Brazil), C. America, Mexico, W. Indies; cultivated in the tropics, largely in some of the W. Indies.

Syn. Semen (Fabæ) Cacao; Ol. Theobrom., Butter of Cacao, Cacao Butter, Oleum Theobromæ; Fr. Cacao, Fèves du Mexique, Beurre de Cacao; Oleum Cacao; Ger. Kakaobohnen; Kakaobutter.

The-o-bro′ma. L. fr. Gr. θεός, a god, + βρῶμα, food, food of the gods—*i. e.*, its delicious qualities.

Ca-ca′o. L. Sp. from Mexican *kakahuati*—*i. e.*, its native name.

Plant.—Handsome tree 9–12 M. (30–40°) high, round branches, bark gray, smooth; leaves 20–22.5 Cm. (8–9′) long, 6 Cm. (2$\frac{2}{5}$′) wide,

lanceolate, acute, round base, entire, veins prominent beneath, petiole 2.5 Cm. (1′) long, thickened at both ends; young leaves pink; flowers pale pink, calyx and corolla 2.5 Cm. (1′) broad, alike in color; fruit large, 15–17.5 Cm. (6–7′) long, broadly fusiform, with 10 shallow furrows and blunt ridges, tuberculated, pendulous, single or 2–3 together, at first yellow, then red, purple, pericarp thick, tough, 5-celled; seed many, closely packed in tiers, size of almonds, angular from pressure, immersed in copious, sweet buttery pulp, seed-coats 2, brownish.

CONSTITUENTS.—SEEDS: Fixed oil 50 p. c., starch 16 p. c., theobromine 1.5–4.5 p. c., caffeine, proteins 18 p. c., sugar .6 p. c., cacao-red 5–6 p. c., volatile odorous principle, ash 3.6–4.6 p. c.

FIG. 262.—*Theobroma Cacao.*

Oleum Theobromatis. Oil of Theobroma.—This fat (concrete fixed oil) is a yellowish-white solid (lighter colored with age), faint, agreeable odor, bland, chocolate-like taste, usually brittle below 25° C. (77° F.), soluble in ether, chloroform, petroleum benzin, benzene, boiling dehydrated alcohol, slightly in alcohol, sp. gr. 0.973, melts at 30–35° C. (86–95° F.); contains stearin 40 p. c., palmitin, laurin, small amounts of glycerides of acetic, butyric, formic, linoleic, and arachidic acids. *Test:* 1. Dissolve 1 Gm. in ether 3 cc. in test-tube at 17° C. (63° F.), immerse test-tube in ice-cold water—liquid not turbid nor does it deposit white flakes in less than 3 minutes, and after congealing should clarify at 15° C.; 59° F. (abs. of wax, stearin, tallow). Dose, ℥ss–1 (2–4 Gm.).

ADULTERATIONS.—Wax, stearin, tallow, etc.

Commercial.—The seed when taken from the fruit (size of cucumber but with pointed ends, consisting of shells 12 p. c. and kernels 88 p. c.)

and dried, still retain astringency and bitterness (kernel), which may be overcome by roasting, or sweating and fermenting in heaps for 1 week, or burying in a box in clayed soil ("clayed," "claying"—best and yellowish) for 3 days, then throwing seed into heaps, covering with leaves for a week, thereby destroying tannin and bitter principle, and developing the derivative constituents on which the properties of chocolate partly depend, then drying. The oil is extracted afterward by: 1, Expression; 2, Decoction; 3, Solution (benzin, carbon disulphide, chloroform, ether), the first process being considered best, and consisting in roasting, discarding shells, grinding kernels, heating at 70° C. (158° F.), subjecting mass to hydraulic pressure between hot iron plates or rollers, then running oil into rectangular molds, where it soon congeals. The residual dryish, oleaginous pulp (expressed cake, oil cake), still containing variable amounts of oil, is utilized as cocoa or chocolate—the former containing the least oil, and both darkened in color and lightened in flavor by an alkali. Chocolate (fr. Ind. *chocolat*), as a confection consists usually of expressed cake finely ground, sugar, vanilla, cinnamon, annatto, etc., molded into varying shapes. Either cocoa or chocolate may be boiled with milk, or milk and water, sweetened, to form a valuable nutritive drink in convalescence from acute diseases. Both are subject to much adulteration with starch, rice flour, barley flour, sassafras nuts, chestnuts, clove, butter, lard, cocco-nut shells, etc.

PREPARATIONS.—(Unoff.) *Emulsion. Ointments. Suppositories.*

PROPERTIES.—Nutrient, demulcent, emollient.

USES.—Seldom internally, only as suppositories, when it acts as an excipient or carrier for other medicine. Externally in cosmetic ointments, pill coating, abraded or inflamed surfaces.

Derivative Products:

1. **Theobrominæ Sodio-Salicylas. Theobromine Sodio-Salicylate,** $C_7H_7O_2N_4Na + NaC_7H_5O_3$, *U.S.P.*—(Syn., Theobrom. Sodio- Sal., Diuretin; Fr. Theobromine et Salicylate de Soude; Ger. Theobrominnatriumsalicylate.) Obtained by mixing aqueous solutions of equal molecules of sodium theobromine and sodium salicylate, evaporating to dryness. It is a white, odorless powder, sweetish, saline, somewhat alkaline taste, gradually absorbs carbon dioxide liberating theobromine, becoming incompletely soluble in water, frequently develops a characteristic odor, soluble in water (1), slightly in alcohol; contains, when dried to constant weight, theobromine 46.5 p. c., salicylic acid 35 p. c., losing water 10 p. c. *Tests:* 1. Ignited—residue produces intensely yellow flame and effervesces with acids. 2. Aqueous solution (1 in 20) colorless, clear, opalescent; aqueous solution (1 in 100), slightly acidulated with acetic acid, + ferric chloride T. S.—violet. 3. .05 Gm. theobromine (separated in assay), + hydrochloric acid 1 cc. + potassium chlorate .1 Gm., dry on water-bath—reddish-yellow residue which becomes purple when moistened with 1 drop of ammonia T. S. 4. Dissolve .1 Gm. in sulphuric acid 2 cc.—no effervescence (abs. of car-

bonate); produces only slight color (abs. of readily carbonizable substances). 5. Dissolve 1 Gm. in water 10 cc., add a few cc. sodium hydroxide T. S., shake with chloroform 10 cc., separate chloroform layer, evaporate to dryness (constant weight)—residue does not exceed .005 Gm. (abs. of caffeine). *Impurities:* Caffeine, sodium carbonate, water, readily carbonizable substances. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), 5–6 times daily, in dilute solution, capsule, wafer, followed by water.

PROPERTIES AND USES.—Diuretic, nervous stimulant; cardiac dropsy, nephritis (chronic, acute), dyspnea, coughs; very slight action on heart and circulation; may produce headache, irregular pulse, vomiting, diarrhea, gastric irritation (avoided by small doses and weak solutions); owing to greater solubility far superior to theobromine. *Incompatibles:* Acids, fruit syrups (decomposing and precipitating theobromine), bicarbonates, borates, phosphates, ferric salts, chloral hydrate, wines, etc.

2. *Theobromine* (dimethylxanthine), $C_7H_8O_2N_4$.—This is obtained by exhausting the kernels with hot water, straining, precipitating with lead acetate, filtering, removing lead with hydrogen sulphide, filtering, evaporating, and treating residue with hot alcohol, from which whitish, bitter crystals deposit. It is a weak base (alkaloid) not altered by solution of potassium hydroxide, slightly soluble in water, alcohol, ether, forms salts (hydrochloride, nitrate, salicylate, etc.), and is related to caffeine, this latter being its methyl derivative—methyltheobromine, into which theobromine may be converted by treating theobromine silver with methyl iodide.

3. *Cacao Præparatum, Cocoa, Prepared Cacao (Chocolate), N.F.*—A powder prepared from the roasted, cured kernel of the ripe seed. It is brownish-red; numerous oil globules, protein grains, starch grains; odor and taste chocolate-like, free from sweetness; yields 6 p. c. of crude fiber, 15 p. c. of starch, and when extracted with ether, 18–25 p. c. of fat—the fatty residue shows not more than 3 p. c. of cocoa shells, and is without spicy odor and taste. Dose *ad libitum;* 1. *Syrupus Cacao,* 5 p. c., + tr. vanill. $\frac{1}{5}$ p. c., alcohol 5, sucrose 80, aq. dest. q. s. 100; 2. *Tabellæ Santonini,* 1 gr (.06 Gm.); 3. *Tabellæ Santonini Compositæ,* 1 gr. (.06 Gm.).

Allied Plants:

1. *Cola ni'tida, Kola, Cola, N.F.*—The dried cotyledon of this or other species with not more than 1 p. c. of foreign organic matter, yielding not less than 1 p. c. of caffeine; W. Africa, W. Indies; cultivated. Tree 15–20 M. (50–65°) high, smooth stem, leaves 15–20 Cm. (6–8′) long, lanceolate-ovate, acuminate, flowers, staminate and pistillate, yellowish, fruit yellowish-brown, 5 segments, rough, woody, follicle 10–13 Cm. (4–5′) long, each segment 1–3-seeded. Cotyledon (seed) irregularly plano-convex, broadly oval, circular, 2.5–5 Cm. (1–2′) long, heavy, hard, tough; brown, outer surfaces wrinkled, inner lighter and smoother, slightly incurved and sharp; odorless; taste slightly

STERCULIACEÆ

astringent. Powder, reddish-brown—numerous starch grains, some altered, many show lamellæ and circular hilum or a central fissure, many parenchyma cells; solvent: diluted alcohol; contains caffeine (kola-tannate) 2.7–3.6 p. c., theobromine, starch 34–42 p. c., tannin, kola-red, kolatin, volatile oil—kolanin is a mixture of kola-red and caffeine, kolatine (only in fresh nuts, which should not be used, action

FIG. 263.—*Cola nitida: a*, leafy branch, ¼ nat. size; also longitudinal section of fruit, cross and natural longitudinal section of seed showing embryo enlarged.

opposite to caffeine). Stimulant, tonic, nervine, diuretic, astringent, similar to coffee, but resembles coca in aiding the endurance of fatigue without food; neuralgia, headache, migraine, diarrhea, indigestion, weak and irregular heart. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Kolæ* (67 p. c. alcohol), dose, ʒss–1 (2–4 cc.). Elixir, 8 p. c., ʒj–3 (4–12 cc.); Tincture, 15 p. c. (diluted alcohol), ʒj–2 (4–8 cc.).

46. THEACEÆ (TERNSTRŒMIACEÆ). Tea Family.

The-a'se-e. L. *The-a* + aceæ, tea, fr. Chinese *Téh* or *Toha*—*i. e.*, native name simulating *Dea*, God. Trees, shrubs. Distinguished by alternate leaves; large showy solitary axillary flowers, sepals 5, petals 5, crenulate, stamens monadelphous; ovary 2-several-celled, superior; fruit 3–5-celled, woody capsule, dehiscent; tropics; stimulant, astringent, sedative.

Genus: **1. Thea.**

THEA. TEA.

Caffeina. Caffeine (Theine), $C_5H(CH_3)_3O_2N_4.H_2O$, *U.S.P.*

Thea sinensis, *Linné,* and **Coffea arabica,** *Linné.* — Trimethyl-xanthine, a feeble basic substance (alkaloid) obtained from the leaves of the former, and seeds of the latter (Rubiaceæ), also occurring in other plants; chiefly prepared synthetically.

Habitat. S. E. Asia, China, India, Japan; cultivated.
Syn. Thea Bohea, Black Tea, Thea viridis, Green Tea; Fr. Thé; Ger. Thee.
The'a. L. see etymology, above, of Theaceæ.
Si-nen'sis. L. (Chinensis) Chinese, of or belonging to China—*i. e.*, its chief habitat.

Plant.—Evergreen shrub 1.2–2 M. (4–6°) high, much branched, bark brown, young twigs downy; leaves 5–10 Cm. (2–4′) long, petiolate, acute at both ends, oval, irregularly serrate, veins prominent, dark green; flowers in winter, 2.5 Cm. (1′) wide, yellowish-white; fruit 3-celled trigonous capsule, with thin brown woody pericarp; diluted alcohol or boiling water exhausts the leaves. Dose, ʒj–2 (4–8 Gm.).

Adulterations.—Prussian blue, indigo, turmeric, gypsum; the three first impart color to water, the last soon deposits; various leaves, recognized by shape, venation, margin, etc.

Commercial.—The plant, springing from seed, begins to yield satisfactory leaves in 3 years, and at 7 attains perfection, being about the height of a man. Three collections are made yearly (Feb., Apr., June), the first, consisting mostly of young leaves, having greatest value. There are two varieties: 1. *Green*, collected more carefully and quickly dried, and containing most tannin; 2. *Black*, owing to slower process, undergoing partial fermentation, which changes color and often impairs quality.

Constituents.—Caffeine (Theine) 1–5 p. c., volatile oil .6–1 p. c., theophylline (isomeric with theobromine), ademine, tannin 11–21 p. c., boheic acid, albumin, resin, wax, ash 4–6 p. c. (14 p. c. being phosphoric acid); leaves yield 40 p. c. of aqueous extract.

Theophyllina. Theophylline, $C_5H_2(CH_3)_2.O_2N_4.H_2O$, *U.S.P.*— (Syn., Theophyll., Dimethylxanthine; Synthetic—Theocine; Ger. Theophyllinum, Theophyllin, Theocin.) This organic base (alkaloid),

isomeric with theobromine, is obtained sparingly from tea leaves, but mostly synthetically by a German patent under the name of theocine, wherein ammonia, carbon dioxide, potassium cyanide, acetic and formic acids are employed in a series of 12 reactions, and in fact becomes our first organic plant base (alkaloid) made on a commercial scale by strictly synthetic methods. It is a white, crystalline odorless powder, bitter taste, permanent, soluble in solutions of potassium hydroxide and in ammonia water, in alcohol (80), water (120), more readily in hot water, sparingly in ether; saturated aqueous solution neutral; melts at 271° C. (520° F.). *Tests:* 1. Dissolve .2 Gm. in 5 cc. of

FIG. 264.—*Thea sinensis.*

potassium hydroxide T. S., or in 5 cc. of ammonia T. S.—clear solution (dif. from caffeine, theobromine, paraxanthine). 2. Dissolve .2 Gm. in 5 cc. of sulphuric acid—only faint yellow (abs. of readily carbonizable substances). 3. Dissolve .01 Gm. in hydrochloric acid 1 cc., add potassium chlorate .1 Gm., evaporate to dryness, invert dish over one containing a few drops of ammonia T. S.—residue purple, destroyed by fixed alkalies. 4. Aqueous solution with tannic acid T. S.—precipitate, soluble in excess of reagent; when dried to constant weight—loses 9.5 p. c. (water); incinerate .1 Gm.—ash negligible. *Impurities:* Caffeine, theobromine, paraxanthine, readily carbonizable substances.

PROPERTIES AND USES.—Claimed to be the best diuretic, increasing amount of urine as well as solids; cardiac affections, nephritis, dropsy; similar to caffeine and theobromine, but much more effective; may produce gastric disturbances, renal irritation, which can be obviated by using its salt—theophylline sodio-acetate. Dose, gr. 3–8 (.2–.5 Gm.), in warm tea.

PREPARATIONS.—(Unoff.): *Fluidextract*, dose, ♏xv–60 (1–4 cc.). *Infusion* (*Tea*), dose, *ad libitum*.

PROPERTIES AND USES.—Similar to coffee, under Rubiaceæ, page 580.

Allied Plants:

1. *Thea* (*Camel'lia*, after George Joseph Camel or Camelli, a Dutch Jesuit missionary and botanist) *japon'ica*.—Japan. An ornamental shrub with poisonous seed. *T. oleo'sa* (*Camellia oleif'era*) and *T. drupif'era*. Seeds resemble those of *T. sinensis* and yield a bland fixed oil—that of *T. drupifera* being fragrant.

47. GUTTIFERÆ (CLUSIACEÆ). Gamboge (Mangosteen) Family.

Gut-tif'e-re. L. fem. pl. *Guttifer—gutta*, a drop, + *ferre*, to bear—*i. e.*, plants yield gum or resinous substances (juice) in drops. Trees or shrubs, allied to Hypericaceæ and Malvaceæ. Leaves coriaceous; flowers perfect; stamens many, distinct, mon- or poly-adelphous; sepals 2–8, often unequal, petaloid; petals 2–8 +; ovary 1-celled, superior; fruit edible; seed oily; tropics; purgative, timber.

Genus: **1. Garcinia.**

CAMBOGIA. GAMBOGE, *U.S.P.*

Garcinia Hanburyi, *Hooker filius.* — The gum-resin with not more than 1 p. c. foreign organic matter, yielding not more than 1 p. c. acid-insoluble ash, nor less than 65 p. c. alcohol-soluble extractive.

Habitat. Annam, Camboja (Cambodia), Siam, Cochin-China.

Syn. Cambog., Pipe Gamboge, Gummi-resina Guttæ (Gutti), Gutta Gamba, Cambodia; Fr. Gomme-gutte; Ger. Gutti, Gummigutt.

Gar-cin'i-a. L. named after Laurent Garcin, French botanist and oriental traveler, who first described it in 1734.

Han-bu'ry-i. L., in memory of Daniel Hanbury, named by Sir Joseph Dalton Hooker.

Cam-bo'gi-a. L. usually called Cambodia, a French protectorate in farther India, where it is indigenous.

Gamboge. The trade name, corruption of Camboge.

PLANT.—A tree 10.5–15 M. (35–50°) high, with many spreading branches; bark orange-brown, thick; leaves 10–17.5 Cm. (4–7′) long, laurel-like; flowers Feb., diœcious, small, yellow, in 4's, staminate ones on pedicels (*pedicula'ta*) 6 Mm. ($\frac{1}{4}$′) long; fruit May–June, size

of crab apple, 3 Cm. ($1\frac{1}{5}'$) in diameter; smooth, orange-green color, with 4 dissepiments, each having 1 seed 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}'$) long. GUM-RESIN (gamboge), in hard, brittle, cylindrical pieces, usually hollow in center, 10–20 Cm. (4–8′) long, 2–5 Cm. ($\frac{4}{5}$–2′) thick, grayish-orange-brown, longitudinally striate; fracture brittle, conchoidal, smooth, dull orange-red surface; odorless; taste acrid. POWDER, bright yellow—few or no starch grains; mounted in chloral hydrate T. S. all particles slowly dissolve leaving a few scattered fragments of vegetable tissues. *Tests:* 1. Dissolves completely by successive treatments

FIG. 265.—*Garcinia Hanburyi.*

of ether or alcohol, and water. 2. Rub with water—yellow emulsion, darker and almost transparent upon adding ammonia T. S.; + iodine T. S.—not green (abs. of starch); not more than 35 p. c. should be insoluble in alcohol. *Solvents:* alcohol or ether dissolves at least 65 p. c. Dose, gr. $\frac{1}{2}$–5 (.03–.3 Gm.).

ADULTERATIONS.—Wheat and rice flour, sand, stones, nails, spikes, powdered wood or bark—mostly in the cake variety, giving greater hardness and coarser fracture; when many fragments of rice paper present—"ricey."

Commercial.—Gamboge secretes in latex-tubes (ducts) in the middle bark and to some extent in the pith, alburnum, leaves, flowers, and fruit; it is at first a yellow milky juice obtained in drops from broken leaves, twigs, or artificial incisions, being caught in leaves, cocoanut shells or bamboo joints. There are two varieties: 1, *Pipe* (*Roll, Fine*), the best, resulting from making, at the beginning of the rainy season, June–Oct., a spiral incision in the bark half around the tree trunk from the ground upward a number of feet, and collecting the slowly exuding juice in a hollow bamboo joint placed at the lower end of the incision, requiring 1–2 months to fill and harden, in which the contraction toward the sides often affords a central cylindrical cavity; upon cracking off the bamboo shell, that usually imparts its markings, the contents are ready for market; trees should only be tapped biennially and each should yield 3 bamboo joints 50 Cm. (20′) long, 4 Cm. ($1\frac{3}{5}$′) thick; 2, *Cake* (*Lump, Saigon, Cochin, Coarse*), inferior, resulting from collecting the juice in leaves and various vessels, being subjected to exposure and adulteration, thereby becoming less uniform and brittle with dull brownish non-conchoidal fracture; usually in masses, 2–3 pounds (.7–1 Kg.), sometimes much larger, being pressed or run into boxes or tubs. Enters market via Canton, Calcutta, Singapore, Saigon, Bangkok, etc.

Constituents.—Gum 16–25 p. c., resin (cambogic acid) 66–80 p. c., volatile oil, phenol ester, methyl alcohol and other alcohols, isovitinic and acetic acids, liquid with fruity odor resembling an aldehyde or ketone, ash 1–3 p. c.

Gum.—Soluble in cold water like gum arabic (*arabin*), but not identical with it, as it is not precipitated by lead acetate, ferric chloride, sodium silicate, or sodium borate.

Resin.—Soluble in ether and alcohol, forming golden-yellow tinctures, also in alkaline solutions with red color, from which it is precipitated unaltered by acids. It has acid characteristics, hence sometimes called cambogic acid, and upon it the coloring matter and medicinal properties depend; with salts of heavy metals forms precipitates called cambogiates.

Preparations.—1. *Pilulæ Hydrargyri Chloridi Mitis Compositæ* (*Pilulæ Catharticæ Compositæ*), $\frac{1}{4}$ gr. (.016 Gm.).

Unoff. Prep.: Pilula Cambogiæ Composita, 16 p. c. +, dose, gr. 4–8 (.26–.5 Gm.).

Poisoning: Similar to aloe, colocynth, elaterin, etc.

Properties.—Drastic, hydragogue cathartic; in small repeated doses diuretic. Usually produces much griping, nausea and vomiting when taken in full doses, so that generally it is combined with other cathartics, as calomel, jalap, potassium bitartrate or carbonate, etc.; it greatly irritates the alimentary canal, especially the small intestine, when taken in excess, and gr. 60 (4 Gm.) have occasioned death; it augments intestinal glands' secretion, but not of bile, and mostly passes in the feces, but some is absorbed, causing yellow urine.

GUTTIFERÆ

Uses.—Liver trouble from malaria; renal dropsy, uremic conditions, congestion of the brain, tenifuge (combined usually with tenicides), vermifuge, dropsy; very uncertain in veterinary practice. Mostly used as pigment in water-color painting. The powder when rubbed up with water shows strongly the "Brownian movement" under the microscope—infinitesimal particles (gamboge, carmine, etc.) suspended in water or other liquid in very delicate equilibrium, and sensitive to slightest change of temperature, which causes movement—physical, not vital.

Allied Plants:

1. Several guttiferous plants of Southern India, not restricted, however, to the Cambodia province, as is the official, are almost identical with this latter and yield a similar juice: *Garcinia Morel'la* (staminate flowers sessile), Ceylon, S. India; *G. travanco'rica*, Travancore; *G. picto'ria*, Madras peninsula, etc.; *G. Mangosta'na, Mango Fruit*, India, astringent; *G. purpu'rea* (*in'dica*), India; the seed of this are exposed to the sun and then boiled in water, when 10–20 p. c. of a fixed oil (kokum-butter) is obtained.

2. *Canel'la Wintera'na* (*al'ba*), *Canella, Canellæ Cortex, White Cinnamon, N.F.*—Canellaceæ. The dried rossed bark with not more than 2 p. c. of foreign organic matter; W. Indies. Tree 9–15 M. (30–50°) high, recognized by whitish bark, leaves thick; flowers white, aromatic; fruit, berries 12 Mm. ($\frac{1}{2}'$) long, blackish. Bark, in quills, usually 5–15 Cm. (2–6′) long, 1–4 Cm. ($\frac{2}{5}$–$1\frac{3}{4}'$) broad, irregular fragments, periderm mostly removed, pale orange-brown, scaly, shallow fissures, ridges; inner surface pale yellow, smoothish; fracture short and sharp; odor slight; unless heated—cinnamon-like; taste aromatic, warm, bitter, mucilaginous. Powder, light brown—numerous stone cells, calcium oxalate rosettes, starch grains, oil cells; solvent: diluted alcohol; contains volatile oil (having eugenol) 1 p. c., resin 8 p. c., bitter principle, calcium oxalate, starch. Aromatic stimulant, tonic, condiment; atonic dyspepsia, menorrhagia, amenorrhea—due to anemia. Dose, gr. 5–30 (.3–2 Gm.); 1. *Pulvis Aloes* (80) *et Canellæ* (20), *Hiera Picra*, dose, gr. 5–10 (.3–.6 Gm.).

Fig. 266.—*Viola tricolor.*

3. *Helian'themum canaden'se, Helianthemum, Rock-rose, Frost-wort* (*-weed*), U.S.P. 1850–1870.—Cistaceæ. The dried herb; N. America. Hoary perennial, 15–45 Cm. (6–18′) high, terete, reddish; leaves 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}'$) long, 4–8 Mm. ($\frac{1}{6}$–$\frac{1}{3}'$) broad, oblong, entire; flowers, 2 kinds, yellow; fruit ovoid capsule; odor slightly aromatic; taste astringent, bitter; solvent: diluted alcohol; contains volatile oil, fixed oil, wax, tannin, glucoside. Tonic, astringent, alterative; prurigo; large doses emetic. Dose, gr. 5–30 (.3–2 Gm.); Decoction, Extract, Fluidextract (diluted alcohol).

4. *Vio'la tri'color, Pansy.*—Violaceæ. The flowering herb, U.S.P. 1880; Europe, N. America, cultivated. Plant 10–30 Cm. (4–12′) high, angular; leaves roundish, cordate; flowers variegated (yellow, whitish, blue, purplish); taste bitter; contains salicylic acid .1 p. c., bitter principle, resin. Alterative, expectorant; large doses emetic, cathartic; skin diseases, scrofula, syphilis, bronchitis, nephritis. Dose, gr. 15–60 (1–4 Gm.); in decoction, infusion, extract. *V. peda'ta, Bird's-foot* or *Blue Violet.* The herb and rhizome, U.S.P. 1820–1870; Europe, N. America. Plant acaulescent; leaves 3–5-divided; flowers bluish; rhizome 25 Mm. (1′) long, 18 Mm. ($\frac{3}{4}$′) thick, bitter, acrid. Used as the preceding.

48. FLACOURTIACEÆ (BIXACEÆ). Arnotto Family.

Fla-court-i-a'se-e. L. *Flacourt-um(-i)* + aceæ—*i. e.*, after Étienne de Flacourt (1607–1660), a French traveler and botanist; governor of Madagascar, 1648–1655. Small trees and thorny shrubs, 1–10 M. (3–30°) high. Distinguished by alternate, stipulate, leathery, dentate leaves; dicœcious flowers, sepals 4–7, slightly cohering, petals equal or wanting, stamens hypogynous, ovary roundish, style none or filiform, stigmas several; fruit 1-celled, often edible, pulp reddish, sweet, wholesome; seeds numerous; E. and W. Indies, Africa; wood, coloring matter, fixed oils valuable; perfumery, culinary, purgative, astringent.

Genera: **1. Taraktogenos. 2. Hydnocarpus.**

CHAULMOOGRA. CHAULMOOGRA.

Oleum Chaulmoograe. Chaulmoogra Oil, *U.S.P.*

Taraktogenos Kurzii, *King,* or certain species of **Hydnocarpus.** } The fixed oil expressed from the seeds.

Habitat. S. Asia; India, Siam, Burma, China, Africa.

Syn. Kalan Tree; Ol. Chaulmoog., Chaulmugra, Chaulmaugra, Oleum Gynocardiæ; Fr. Huile de Chaulmougra (Chaulmougrè); Ger. Chaulmugroöl.

Ta-rak'to-ge'nos. L. fr. Gr. ταρακτός, confused, disordered, jumbled up, + γένος, genus, race—*i. e.*, genus that was overlooked and once confused with *Hydnocarpus.*

Kur'zi-i. L. named by Prof. Geo. King (1890) in honor of Prof. Sulpiz Kurz, author of *Forest Flora* of British Burma, and curator, Royal Botanical Gardens, Calcutta.

Hyd-no-car'pus. L. fr. Gr. ὕδνον, edible fungus-truffle, + καρπός, fruit—*i. e.*, alluding to superficial appearance of fruit.

Chaul-moo'gra. L. fr. native Asiatic (Burmese) name.

Plant.—Large tree, 7–15 M. (21–40°) high, smooth, pale yellowish bark, straight trunk, branches at right-angles, but drooping down; fruit size of large orange, light fawn color, velvety; seed numerous, irregularly imbedded in fleshy pulp, brownish-yellow, 2–3 Cm. ($\frac{4}{5}$–$1\frac{1}{5}$′) long, more or less angular flattened, not as broad, roundish ends.

FLACOURTIACEÆ

CONSTITUENTS.—SEEDS: Fixed oil, 25–50 p. c., starch, proteins, tannin, coloring matter, ash 1–5 p. c.

Oleum Chaulmoogræ. Oil of Chaulmoogra.—This fixed oil is a yellow, brownish-yellow liquid, or below 25° C. (77° F.), a whitish, soft solid; characteristic odor, somewhat acrid taste; soluble in benzene, chloroform, ether, petroleum benzin, sparingly in alcohol, sp. gr. 0.950; contains palmitin, linolein, but chiefly glycerides of two fatty acids—chaulmoogric, $C_{18}H_{32}O_2$, and hydnocarpic, $C_{16}H_{23}O_2$; both acids are optically active but differ from ordinary fatty acids in having a five atom carbon ring with an unstable hydrogen atom; both acids are readily converted into ethyl esters having therapeutic advantages over the oil; both acids form crystals that melt at 60–68° C. (140–155° F.). *Tests:* 1. Dissolve 1 Gm. in 15 cc. of a mixture of equal vols. alcohol and ether previously neutralized with $\frac{N}{10}$ sodium hydroxide, using 5 drops

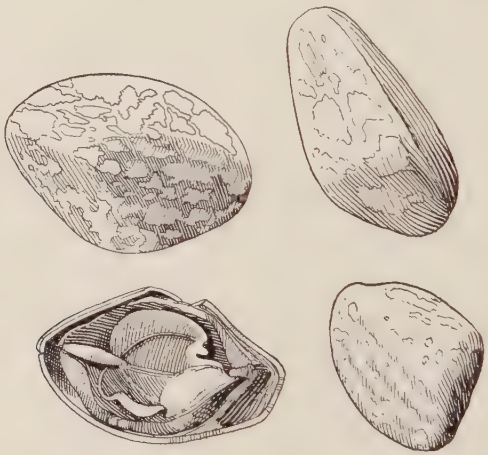


FIG. 267.—*Taraktogenos Kurzii:* whole seed; longitudinal section.

phenolphthalein T. S., indicator, when titrated with $\frac{N}{10}$ sodium hydroxide to pink color—1.8–5 cc. should be required (abs. of free acid); forms salts—sodium chaulmoograte, sodium hydnocarpate, etc. Should be kept cool, dark, in well-closed containers. Dose, ♏v–30 (.3–2 cc.).

Æthylis Chaulmoogras. Ethyl Chaulmoograte, *U.S.P.*—(Syn., Æthyl. Chaulmoog.; Fr. Chaulmougrè d'éthyle; Ger. Chaulmeströl, Antilepröl). This mixture of ethyl esters of the fatty acids (chaulmoogric and hydnocarpic) of chaulmoogra oil, obtained by fractionating, is a clear, pale, yellow liquid, with slight fruity odor, miscible with alcohol, chloroform, ether, insoluble in water, sp. gr. 0.904. *Test:* 1. 1 cc. in 10 cc. neutralized alcohol, using 2 drops phenolphthalein T. S.—requires not more than .1 cc. $\frac{N}{10}$ sodium hydroxide for neutralization (abs. of free acid); its fluidity is its chief advantage over the oil, although

it has a more agreeable taste and is less irritating when injected. Should be kept in well-closed containers. Dose (mouth, intramuscular injection), ℿxv–60 (1–4 cc.).

Adulterations.—Various hydnocarpus oils not agreeing with physical and chemical properties of oil of chaulmoogra; gynocardia oil.

Commercial.—The seeds are washed, dried in the sun, shelled, crushed and subjected to hydraulic pressure; yield 25–32 p. c. oil (best); extraction with ether or other volatile solvents—35–41 p. c. There are several varieties: 1. True Oil of Chaulmoogra (*Taraktogenos Kurzii*); 2. Lukrabo Oil (*Hydnocarpus anthelmin'tica*), Siam, imported, as are the seeds, into China, where it is called Tafungtsze; 3. Oil from *Hydnocarpus Wightia'na*, synonymous with *H. inebria'ns*, yields a very similar and effective oil.

Properties.—Alterative, germicide, antiseptic, counter-irritant, blood-purifier; large doses toxic to dogs and rabbits causing vomiting, loss of appetite (central origin), destructive of blood corpuscles (hemolytic); in fatal intoxication—fatty degeneration of liver, irritation of kidneys; only two cases of fatty embolism of lungs, in man (hypodermic injection)—no serious poisoning so far reported.

Uses.—Leprosy—practically a specific against *Lep'ra bacil'lus*, when it must be used freely, internally and externally for 2–3 years, supplemented by nourishing diet to maintain bodily vigor; action may be due to stimulation of leukocytosis, or to its powerful germicidal effect, exceeding 100 times that of phenol; may have solvent power on the waxy coating of acid-fast bacilli, and may be absorbed by alimentary tract; but intramuscular injection gives best results; hypodermic injections of ethyl esters into leprous nodules cause them to swell to an ultimate recession, 50 p. c. of the cases being curable; also used for sores, wounds, sprains, bruises, tuberculous ulcers of larynx, and with doubtful effect on *Tubercle bacillus*.

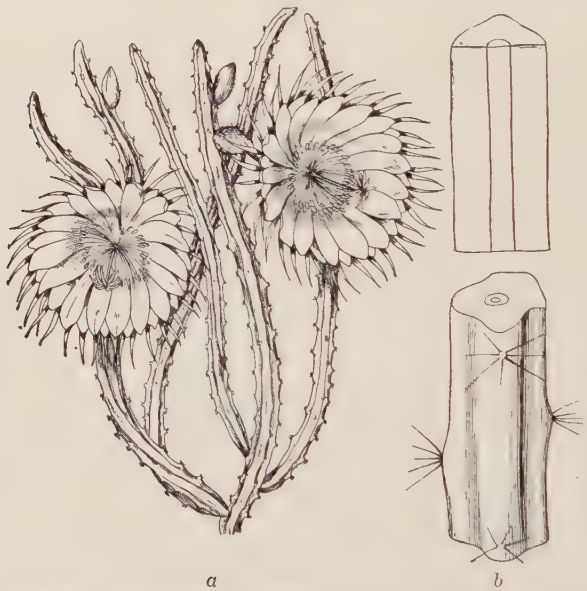
Allied Plants:

1. *Tur'nera diffu'sa*, or *T. aphrodisi'aca, Damia'na, Turnera, N. F.*—Turneraceæ. The dried leaf with not more than 15 p. c. of stems nor 3 p. c. of other foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; W. Mexico, S. California, Texas. Leaves obovate, 10–25 Mm. ($\frac{2}{5}$–1′) long, 4–10 Mm. ($\frac{1}{6}$–$\frac{2}{5}$′) broad, short-petioled, acute, cuneate base, 2–10-toothed on each side, smooth, light green; lower surface densely tomentose (*T. diffusa*), or glabrous, with few hairs on ribs (*T. aphrodisiaca);* frequently some reddish twigs; flowers yellowish, globose pods; odor aromatic; taste characteristic, aromatic, resinous. Powder, yellowish-green—stomata, hairs, tracheæ, few tracheids from stem, calcium oxalate crystals in rosettes or prisms, starch grains; solvent: diluted alcohol; contains volatile oil (amber-colored, aromatic odor, warm camphoraceous taste) .5 p. c., damianin (bitter principle), 2 resins 6.4 p. c., tannin 3.5 p. c., starch, ash 10 p. c. Aphrodisiac, tonic, stimulant, laxative; sexual impotence, in conjunction with strychnine, phosphorus. Dose, ʒss–2 (2–8 Gm.); 1. *Fluidextractum*

FLACOURTIACEÆ

Damianæ (75 p. c. alcohol), dose, ʒss–2 (2–8 cc.); Infusion—substitute for tea.

2. *Passiflo'ra incarna'ta, Passion Flower* (*Vine*), *N.F.*—Passifloraceæ. The dried flowering and fruiting top with not more than 5 p. c. of stems over 8 Mm. ($\frac{1}{3}'$) thick or other foreign matter; S. United States (Va., N. C.). Slender climbing plant; stems glabrous, pubescent, variable length, 6–8 Mm. ($\frac{1}{4}$–$\frac{1}{3}'$) thick, striate, woody, hollow; bark thin, greenish, purplish; wood porous, fracture uneven, fibrous; leaves broken, thick, glabrous or pubescent, orbicular, cordate, 3–5-lobed, serrate; many tendrils; flowers yellow, corona purplish, monadelphous in a tube; fruit, many-seeded berry; seed flat, yellowish; odor and taste



a *b*

FIG. 268.—*Selenicereus grandiflorus: a*, flowering stem; *b*, section of stem, showing cross and longitudinal sections.

slight. Powder, light green—non-glandular hairs, pith and wood parenchyma, tracheæ, chlorenchyma and epidermal cells, stomata, calcium oxalate rosettes; solvent: diluted alcohol; contains alkaloid, ash 3–12 p. c. Narcotic, anodyne, nerve sedative; insomnia, restlessness, neuralgia, convulsions, epilepsy, tetanus; burns, hemorrhoids, diarrhea. Dose, gr. 5–10 (.3–.6 Gm.); 1. *Tinctura Passifloræ*, 20 p. c. (diluted alcohol), dose, ♏x–30 (.6–2 cc.); Inspissated juice of leaves, ʒj–4 (4–15 cc.).

3. *Car'ica Papa'ya, Pawpaw, Melon Tree; Papayotin, Papain, Caricin.*—An albuminous ferment from the fruit; Tropical America. Tree 6 M. (20°) high, stem 30 Cm. (12′) thick, fruit approximates the size of one's head, and contains an acrid, astringent, bitter, milky

juice, which soon separates into a coagulum and aqueous liquid, from which latter papayotin is precipitated upon the addition of alcohol. It is a whitish, hygroscopic powder, inodorous, tasteless, soluble in water, glycerin, active in neutral, acid, but more so in alkaline solutions; it converts starch into maltose, albuminoids into peptones, and emulsifies fats; should digest 200 times its weight. Papoid, Caroid, etc., are weaker forms (dried juice); slightly inferior to pepsin, greatly inferior to pancreatin. Dose, gr. 2–5 (.13–.3 Gm.).

4. *Selenice'reus grandiflo'rus*, *Cactus Grandiflorus*, *Night Blooming Cereus*, *N.F.*—Cactaceæ. The fresh succulent stem of the wild growing plant; Mexico, W. Indies, cultivated. Small shrub, .3–1 M. (1–3°) high; stem green, fleshy, branching; flowers white, sessile, large, fragrant, opening at night, petals and stamens numerous; fruit white berry, size of an egg. Stem (drug) in pieces of varying length, 1.5–4 Cm. ($\frac{3}{5}$–$1\frac{3}{5}$′) thick, 5–9-angled, angles 2 Cm. ($\frac{4}{5}$′) apart with tufts of 9–12 acicular spines, each 5 Mm. ($\frac{1}{5}$′) long, and same number of bristles 1 Cm. ($\frac{2}{5}$′) long, branched roots at irregular intervals; odor strong, herby; taste acidulous, mucilaginous; solvent: alcohol; contains cactine, acid resinous glucoside, resins, calcium oxalate. Cardiac stimulant (tonic), diuretic, similar to digitalis, but non-cumulative, counter-irritant; cardiac palpitation and weakness, heart failure from valvular disease, angina pectoris, aortic regurgitation, dropsies, low fevers, Graves' disease, tobacco toxemia, sexual exhaustion. Dose, gr. 5–10 (.3–.6 Gm.); 1. *Tinctura Cacti Grandiflori*, 50 p. c. (alcohol), dose, ℥xv–30 (1–2 cc.). Decoction, 5 p. c., ʒj–2 (4–8 cc.); Fluidextract.

Fig. 269.—*Daphne Mezereum.*

5. *Daph'ne Meze'reum*, *D. Gnid'ium*, or *D. Laure'ola*, *Mezereum*, *Mezereon*, *N.F.*—Thymelæaceæ. The dried bark from aërial portions with not more than 2 p. c. of foreign organic matter; Europe, Siberia, New England. Small slender herbs, .3–1.3 M. (1–4°) high, branching; leaves 5–7.5 Cm. (2–3′) long, obovate, sessile, entire; flowers fragrant, tubular, rose red (1), white (2), yellowish-green (3); fruit ovate, bright red (1), scarlet (2), purplish-black (3). Bark in flexible, tough quills, flattened strips up to 90 Cm. (3°) in length, .3–1 Mm. ($\frac{1}{75}$–$\frac{1}{25}$′) thick, yellowish-brown (1), purplish-brown (2), purplish-gray (3), smooth, numerous lenticels, brownish-black apothecia, corky layer easily separable from middle bark, inner surface yellowish-white, satiny, lustrous, finely striate; fracture tough, fibrous; odor slight; taste at first slight, increasingly pungent, acrid. Powder, light grayish-brown—numerous bast-fibers, attenuated ends, walls free from pores, brownish cork cells, starch-bearing medullary rays, few starch grains; solvents;

diluted alcohol, boiling water; contains acrid resin, acrid volatile oil, daphnin, wax, sugar, yellow coloring matter, malic acid; by dry distillation yields umbelliferon. Alterative, stimulant, diuretic, diaphoretic, sialagogue, vesicant; syphilis, scrofula, rheumatism, skin diseases; externally—local irritant like cantharides, applied to indolent ulcers to make them again active, also to maintain discharges from setons, fly blisters, etc. *Poisoning:* Have vomiting, purging, cold sweats, prostration, collapse, convulsions, death—evacuate stomach with warm demulcent drinks, then milk, fatty oils, opium, stimulants. Dose, gr. 1–10 (.06–.6 Gm.); 1. *Fluidextractum Mezerei*, (67 p. c. alcohol): Prep.: 1. *Linimentum Sinapis Compositum*, 20 p. c. 2. *Fluidextractum Sarsaparillæ Compositum*, 3 p. c. Decoction; Extract. *Daphne salicifo'lia;* Mexico—leaves used natively as a vesicant; fruits of the various species contain 31 p. c. of fixed oil.

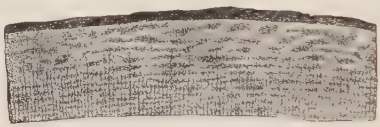


Fig. 270.—Mezereum: transverse section, magnified 15 diam.

6. *Lophoph'ora* (*Anhalo'nium*) *William'sii* (*Lewinii*), *Mescal(e) Buttons;* Mexico.—This small succulent cactus yields the mescal buttons (upper layer of turnip-shaped stem, consisting of ovoid tubercles, dried) which are used by the Rio Grande Indians to produce intoxication—similar to cannabis, during religious ceremonies; contain anhalonine (similar to pellotine), mescaline, anhalonidine, lopophorine. Heart and respiratory stimulant, tonic, adjuvant to digitalis, narcotic; slightly slows pulse, produces mental and physical weariness, sleep without untoward symptoms; excessive quantities produce spasms resembling strychnine poisoning; pneumothorax, tuberculosis, angina pectoris, asthmatic dyspnea, hysteria. Dose, (pellotine), gr. ½–2 (.03–.13 Gm.); Fluidextract, ♏v–10 (.3–.6 cc.).

49. LYTHRACEÆ (PUNICACEÆ). Loosestrife Family.

Lith-ra'se-e. L. *Lythr-um* + aceæ, fr. Gr. λύθρον, gore—*i. e.*, from its purple flowers. Herbs, shrubs, often 4-sided; distinguished by containing astringent principle, coloring agent. Leaves exstipulate; calyx tubular, persistent, bearing deciduous petals and stamens; lobes valvate; petals 4–7, wrinkled; stamens 4–14, perigynous, inserted below petals; ovary 1–2–6-celled, superior; ovules many; style 1; stigma rarely 2-lobed; fruit capsule, membranous, dehiscent, surrounded by non-adherent calyx-tube; seeds many, exalbuminous; temperate climates, tropics; astringent, dye.

Genus: **1. Punica.**

GRANATUM. POMEGRANATE, *U.S.P.*

Punica Granatum, *Linné.* { The dried bark of the stem or root, with not more than 2 p. c. wood, or other foreign organic matter.

Habitat. S. W. Asia, India, Persia, Arabia, China, Japan, E. and W. Indies; naturalized in subtropics, S. United States, etc.; cultivated for fruit, ornamental flowers.

Syn. Granat., Pomegranate Bark, Grenadier, Punic (Carthaginian, Garnet) Apple; Granati Cortex; Fr. Écorce de (Grenadier) Balaustier; Ger. Granatrinde.

Pu'ni-ca. L. *punicus*, of or belonging to Carthage, near which city it is said to have first been found, or fr. *puniceus*, scarlet—*i. e.*, the color of its flowers.

Gra-na'tum. L. *granatus*, having many grains or seeds, fr. *granum*—*i. e.*, the many-seeded fruit.

Pome'gran-ate. L. *pomum*, a fruit, + *granatus*, grained.

PLANT.—Shrub or small tree, 4.5 M. (15°) high, branches angular, with spiny ends; young shoots and buds red; leaves 2.5–5 Cm. (1–2′)

FIG. 271.—*Punica Granatum:* flower.

FIG. 272.—*Punica Granatum:* flowering branch.

long, shining, lanceolate, entire, half evergreen; flowers June–Sept., large; calyx shining, scarlet, tubular, 3 Cm. ($1\frac{1}{5}$′) long; corolla crimson, 5–7 petals; fruit (balausta), 5–10 Cm. (2–4′) broad, resembles an orange, quince, or tomato, 5–8-angled over the dissepiments, short-necked at top. Internally, below the median line, divided by a dia-

LYTHRACEÆ

phragm into two stories—upper with 5–9 irregular cells, lower and smaller with 1–3 vertical partitions (cells); seed angular 12 Mm. ($\frac{1}{2}'$) long, so numerous that they, with the thin surrounding edible pulp, fill entire fruit. Bark (stem), in pieces 2–8 Cm. ($\frac{4}{5}$–$3\frac{1}{5}'$) long, .5–3.5 Mm.

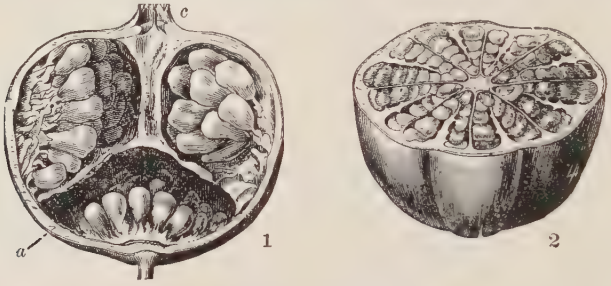


Fig. 273.—*Punica Granatum: 1*, longitudinal cross-section; *2*, transverse cross-section; *a*, inner rind and ovules; *c*, the remaining calyx.

($\frac{1}{50}$–$\frac{1}{7}'$) thick, yellowish-brown, with patches of grayish lichens, elliptical lenticels, furrows or abraded patches of cork, wrinkled; inner surface light yellow, finely striate; fracture short, phelloderm dark green; inner bark yellowish-green; (root) in transversely curved pieces yellowish-brown, conchoidal depressions, irregular patches of cork; internally dark yellow, medullary rays extending nearly to outer surface; odor slight; taste astringent, bitter, nauseous. Powder, yellowish-brown—calcium oxalate in rosette aggregates, numerous starch grains, .002–.01 Mm. ($\frac{1}{1250}$–$\frac{1}{250}'$) broad, whitish cork, stone cells, long wood fibers, tracheæ. *Tests:* 1. Macerate 1 Gm. for 1 hour in distilled water 100 cc., add to 10 cc. of yellow filtrate 1 drop of ferric chloride T. S.—bluish-black precipitate; to another 10 cc. add 40–50 cc. of calcium hydroxide T. S.—orange-brown flocculent precipitate. Should be kept in tightly-closed containers. *Solvents:* boiling water; diluted alcohol. Dose, ʒss–2 (2–8 Gm.).

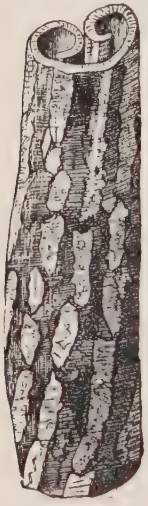


Fig. 274.—Granati cortex: bark of the root.

Substitutions.—1, *Bux'us semper'virens, Boxwood Bark;* 2, *Berberis vulgaris, Barberry Bark;* neither contain tannin, hence infusions do not precipitate blue-black with iron like pomegranate bark; they also are very bitter, and the former has a nearly white inner surface; 3, *Granati Fructus Cortex;* this contains tannin 19–28 p. c., extractive 21 p. c., gum 34 p. c., and has the same effect as the bark.

Commercial.—Root-bark is three times stronger in alkaloids than stem-bark, but both deteriorate rapidly with age owing to the alka-

loids undergoing decomposition; the white-flowered plant yields the richest bark which is imported chiefly in the dry state from France, Italy, although we use much of our native product. In addition to bark occasionally the flowers, fruit, rind, and acidulous seed-coating are employed domestically; some prefer the bark from uncultivated plants.

CONSTITUENTS.—Tannic acid 20–22 p. c., Alkaloids 1.71 (black-flowered)–2.43 (red-flowered)–3.75 p. c. (white-flowered)—Pelletierine (punicine) .5–1.5 p. c., iso-pelletierine, methyl-pelletierine, pseudo-pelletierine (granatonine), mannite (punicin, granatin), gallic acid, sugar, gum, pectin, calcium oxalate, ash 10–16 p. c.

Tannic Acid, $C_{20}H_{16}O_{13}$.—This is a mixture of gallotannic acid and punicotannic (granatotannic) acid, the latter insoluble in alcohol, ether, precipitates gelatin, tartar emetic, iron salts, with dilute acids splits into sugar and ellagic acid.

Pelletierine, $C_8H_{15}ON$ (in honor of Pelletier).—This is obtained by mixing bark with milk of lime, displacing with water, exhausting percolate with chloroform. It is regarded by Tanret, its discoverer, to be the anthelmintic constituent, and is a colorless, oily, aromatic alkaloid, resinifying on exposure, soluble in water, alcohol; forms crystalline salts (nitrate, sulphate, tannate, etc.)—considered to be a mixture of the several alkaloids. Dose, gr. 3–8 (.2–.5 Gm.).

FIG. 275.—Granati cortex: transverse section, magnified 10 diam.

Pelletierinæ Tannas, Pelletierine Tannate, *U.S.P.*—(Syn., Pellet. Tann., Punicine Tannate; Fr. Tannate de Pelletierine; Ger. Pelletierinum tannicum, Gerbsaures (Pelletierin) Punicin.) This is a mixture in varying proportions of the tannates of four alkaloids (punicine, iso-punicine, methyl-punicine, pseudo-punicine), and is obtained by mixing ground bark with milk of lime, percolating with water until exhausted, shaking out percolate with chloroform, and chloroformic solution of free alkaloids with very dilute sulphuric acid; to neutral solution of mixed sulphates add solution tannic acid, whereby tannates are precipitated, dry. It is a light yellow, odorless, amorphous powder, astringent taste and weak acid reaction, soluble in water (250), alcohol (16), ether (420), warm dilute acids, insoluble in chloroform; ash from .2 Gm.—negligible. *Tests:* 1. Aqueous solution with ferric chloride T. S.—blue-black color. 2. Cold solution of .1 Gm. in 4 cc. of distilled water + 1 cc. of diluted hydrochloric acid, + platinic chloride T. S.—no precipitate (abs. of many foreign alkaloids). 3. Dissolve .5 Gm. in sodium hydroxide T. S., shake with 4 successive portions of chloroform, 10, 5, 5, 5 cc., acidulate combined solutions with .1 cc. of hydrochloric acid, evaporate to apparent dryness, dissolve residue in 5 cc.

alcohol, evaporate, dry 1 hour—residue not less than 20 p. c. Should be kept dark, in small, well-closed containers. Dose, gr. 3–8 (.2–.5 Gm.) in ℥j (30 cc.) of water.

Preparations.—1. *Fluidextractum Granâti.* Fluidextract of Pomegranate. (Syn., Fldext. Granat., Fluid Extract of Pomegranate; Fr. Extrait fluide d'Écorce de (Grenadier) Balaustier; Ger. Granatrinden-fluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st menstruum: alcohol 50 cc., water 40, glycerin 10; 2d menstruum: diluted alcohol. Dose, ℥ss–1 (2–4 cc.).

Unoff. Preps.: Decoction, 20 p. c., ℥ss–2 (15–60 cc.). *Rind,* gr. 15–30 (1–2 Gm.).

Properties.—Anthelmintic, tenifuge, astringent.

Uses.—The ancients knew its value as a vermifuge (Celsus, Dioscorides, Pliny). In Hindustan, Mohammedan physicians used it in tenia, one of whom made public the secret in 1804; French physicians prefer the wild-grown plant. Externally and internally astringent; large doses occasion vomiting, purging, cramps, numbness in the legs, giddiness, dim vision, increased urine. The rind is also astringent in diarrhea, leucorrhea, hemorrhage, cancerous and other ulcers of uterus and rectum; intermittent fever. For tape-worm take decoction made by boiling bark ℥ij (60 Gm.) + water Ojss (.7 L.) down to Oj (.5 L.); give this in 3 divided doses at hour intervals in the morning on empty stomach. It is well, a couple of hours after administration, to follow with castor oil ℥j (30 cc.) or compound tincture of jalap ℥j (30 cc.). The worm should be passed sitting in a tepid sitz-bath, thus preventing the expelled portion tearing from the head by its weight; it passes usually in a knotted mass. Pomegranate may also be used for tanning, dyeing; the fruit as a refreshing, cooling article of food.

50. MYRTACEÆ. Myrtle Family.

Mer-ta'se-e. L. *Myrt-us* + aceæ, Gr. *μύρτος,* myrtle, fr. *μύρον,* perfume—*i. e.*, characteristic of some species. Trees, shrubs; distinguished by aromatic, pungent properties (vol. oil); stamens 8–10 +; leaves exstipulate, opposite, dotted with marginal vein; calyx and petals 4–5; ovary inferior, 1–6-celled; fruit dry or succulent; seeds exalbuminous; temperate climates, tropics; aromatic, stimulant, carminative (vol. oil), diaphoretic, antispasmodic, astringent, spices, perfumery, edible fruit; timber.

Genera: **1. Caryophyllus. 2. Melaleuca (Cajuputi). 3. Eucalyptus.**

CARYOPHYLLUS. CLOVE, *U.S.P.*

Caryophyllus aromaticus, *Linné.*

The dried flower-buds with not more than 5 p. c. stems nor 1 p. c. other foreign organic matter, yielding not less than 15 p. c. volatile ether-soluble extractive nor more than 10 p. c. crude fiber nor .75 p. c. acid-insoluble ash.

Habitat. Molucca (Spice or Clove) Islands, five in number, N. E. of Celebes, now mostly abandoned there, but cultivated in Indian Ocean islands, Amboyna group, Sumatra, Malacca, Penang. etc., S. America, Brazil, Guiana, Cayenne, Africa, Zanzibar, West Indies.

Syn. Caryoph., Cloves, Mother Cloves, Caryophylli Aromatica; Br. Caryophyllum; Fr. Girofle, Clous (aromatiques) de Girofle; Ger. Gewürznelken; Flores Caryophylli, Nägelein.

Car-y-o-phyl'lus. L. fr. Gr. *κάρυον*, a nut, + *φύλλον*, a leaf—*i. e.*, referring to the appearance of flower buds.

Ar-o-mat'i-cus. L. aromatic, fragrant—*i. e.*, its aromatic aroma, odor.

Clove. L. *clavus*, a nail—*i. e.*, the resemblance of its dried flowers.

PLANT.—Handsome evergreen tree, 9–12 M. (30–40°) high, much branched, forming a pyramidal crown; bark yellowish; leaves 10 Cm. (4′) long, 5 Cm. (2′) wide, entire, smooth, glandular, parallel veins to midrib, petiolate; flowers 15–20, rose-color, cymes; fruit berry-like. FLOWER-BUDS (clove), tack-shaped, 10–17.5 Mm. ($\frac{2}{5}$–$\frac{3}{4}$′) long, dark

FIG. 276.—*Caryophyllus aromaticus.*

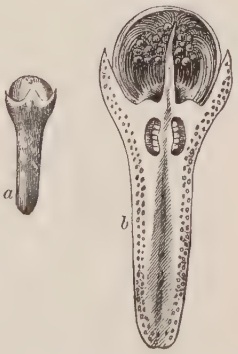


FIG. 277.—Caryophyllus: *a*, natural size; *b*, longitudinal section magnified.

brown, consisting of a stem-like, solid, inferior ovary, obscurely 4-angled, terminated by 4 calyx teeth, and surmounted by a nearly globular head, consisting of 4 petals enclosing numerous curved stamens and 1 style; odor strongly aromatic; taste pungent, aromatic, followed by slight numbness; pressed strongly between thumbnail and finger—volatile oil visible; should not float horizontally on water; stems, separate or attached, sub-cylindrical, 4-angled, 25 Mm. (1′) long, 4 Mm. ($\frac{1}{6}$′) thick, simple, branched, jointed, less aromatic than flower-buds. POWDER, dark brown—parenchyma fragments with large oil reservoirs, spiral tracheæ, few bast-fibers, calcium oxalate rosette aggregates, numerous tetrahedral pollen grains, *Tests:* 1. Stone cells irregular or polygonal, with thick porous walls and large lumina, often filled with yellowish-brown amorphous substance—few or absent (abs. of less than 5 p. c. of stems). 2. No starch grains present (abs. of clove fruit or cereals). *Solvents:* alcohol (volatile oil,

resin); water (odor—part of volatile oil but none of the pungent resin). Dose, gr. 5–10 (.3–.6 Gm.).

Adulterations.—Flower-buds: Clove-stalks, 2 Mm. ($\frac{1}{12}'$) thick, brown, contain volatile oil 4–5 p. c., for which they are imported as well as for their well-defined stone cells; mother clove (clove fruit, anthophylli) collected just before ripe, 2.5 Gm. (1′) long, resemble clove, but thicker, lighter, weaker, with 4-lobed calyx, each cell 1–2-seeded, contain volatile oil 2–4 p. c.; exhausted clove, such as have undergone partial or complete exhaustion and distillation; pimenta, different shape and aroma; an artificial clove molded from a paste has been reported; Powder: All of the above—detected chiefly by peculiar starch grains, stone cells, and weakness of the preparations; cassia; ginger; sand; starch; flour; pepper shells. Oil: That from which eugenol has been abstracted or foreign eugenol added; clove-stem oil, alcohol, oils of turpentine, cinnamon, pimenta and copaiba, petroleum, fixed oils, phenol.

Commercial.—Trees yield when 6 years old, reach perfection at 12, and thence decline until, at 20, they perish. Clove (flowers, buds) at first are white, then green, pink, and bright red, being collected at the pink stage by hand-picking on ladders and platforms, or by beating the trees with bamboos and catching the falling buds upon outspread cloths, after which they are dried by sun or slowly by fire. Each tree yields 5 pounds (2.3 Kg.), which are disposed of at 10 cents per pound (.5 Kg.). Clove was unknown to the ancients, having been brought to Europe by the Arabians and Venetians, while the Portuguese and Dutch long monopolized the trade. Now mostly from Zanzibar, the finest from Penang, some from Pemba, or via Bombay; however, much of our supply is from W. Indies, Cayenne, Guiana, etc. There are three varieties: 1, *Molucca* (*Amboyna*), thickest, heaviest, darkest, most oily and aromatic; two annual harvests, June, Dec., in the Moluccas; 2, *Sumatra* (*Bencoolen*), considered by some of equal high grade as the preceding; 3, *S. American*, usually not so fine, but the freshest, contain volatile oil 10–15 p. c.

Clove(s) that are light (floating horizontally on water), small, soft, wrinkled, of pale color, feeble taste and smell, often without corolla bud or "head," are inferior from having been treated with a menstruum, or careless picking (including immature green and red buds) and drying (which should be done quickly and without exposure to bad weather), and should not be used direct or in obtaining the oil.

Constituents.—Volatile oil 18 p. c., eugenol, eugenin (white pearly scales, isomeric with eugenol—red with nitric acid), $C_{10}H_{12}O_2$, caryophyllin, tannin 10–13 p. c., resin (tasteless) 6 p. c., gum 13 p. c., vanillin, furfurol, green wax, cellulose 28 p. c., water 18 p. c., ash 4–8 p. c. (of which .5 p. c. is insoluble in hydrochloric acid).

Oleum Caryophylli. Oil of Clove, *U.S.P.*—(Syn., Ol. Caryoph., Clove Oil, Oil of Cloves; Fr. Essence de Girofle; Ger. Oleum Caryophyllorum, Nelkenöl, Eugenol.) This volatile oil distilled from the

dried flower-buds (clove) with water or steam, and usually 3 p. c. of sodium chloride, to raise the ebullition-point possibly to 109.5° C.; (229° F.), is a colorless, pale yellow liquid, darker and thicker by age and exposure, characteristic odor and taste of clove, soluble in 2 vols. of 70 p. c., alcohol, levorotatory, sp. gr. 1.038–1.060; contains at least 82 (80–90) p. c. of eugenol, $C_{10}H_{12}O_2$ (heavy portion—phenol), caryophyllene, $C_{15}H_{24}$ (light portion, polymeric with terpene, $C_{10}H_{16}$, sp. gr. 0.918—sesquiterpene), also 2–3 p. c. of eugenol acetate; methyl-amylketone (gives odor), vanillin, furfurol (causes oil to darken), methyl alcohol. *Tests:* 1. Shake oil (1) with hot distilled water (20)—shows only slight acid reaction; filtrate with 1 drop of ferric chloride T. S.—transient grayish-green color, but not blue or violet (abs. of phenol). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

Eugenol. **Eugenol,** $C_{10}H_{12}O_2$, *U.S.P.*—(Syn., Eugenolum, Eugenin, Caryophyllic Acid, Eugenic Acid, Allylguaiacol, Ethylmethyl-pyrocatechol, Para-oxy-metamethoxyallyl benzol.) This unsaturated, aromatic phenol (found also in oils of bay, canella, camphor, cinnamon (Ceylon), sassafras, pimento, Massoi bark) is obtained by shaking oil of clove with excess of 5–10 p. c. solution of sodium hydroxide in a separator, drawing off resulting solution of eugenol sodium, washing aqueous liquid with ether, decomposing with diluted sulphuric acid, washing separated eugenol with sodium carbonate solution (to remove adhering acid), distilling with steam or *in vacuo*. It is a colorless, pale yellow, thin liquid, strongly aromatic odor of clove; pungent, spicy taste; darker and thicker on exposure to air; miscible with alcohol, chloroform, ether, fixed oils, soluble in 2 volumes of 70 p. c. alcohol; mixed with hot distilled water (1 in 20) very slightly acid, sp. gr. 1.067, boils at 253° C. (488° F.); optically inactive and strongly refractive. *Tests:* 1. Dissolve 1 cc. in sodium hydroxide T. S. (12), add distilled water (18)—clear solution, turbid on exposure to air (abs. of hydrocarbons). 2. Shake 1 cc. with distilled water (20); to 5 cc. of clear filtrate add 1 drop of ferric chloride T. S.—transient, grayish-green, not blue or violet (abs. of phenol); upon eugenol alone the value of oil of clove depends. Should be kept cool, dark, in well-closed containers. Dose, ♏j–5 (.06–.3 cc.).

Caryophyllin, $C_{10}H_{16}O$.—Obtained by treating ethereal extract of clove with water, filtering and treating the resulting precipitate with ammonia to purify; occurs in tasteless, inodorous silky needles, soluble in ether, slowly in alcohol, colored red with sulphuric acid, and by oxidation with nitric acid yields crystals of caryophyllinic acid, $C_{20}H_{32}O_6$.

PREPARATIONS.—CLOVE: 1. *Tinctura Lavandulæ Composita,* ½ p. c. 2. *Tinctura Rhei Aromatica,* 4 p. c. 3. *Pulv. Arom. Rubefac., Rubefac. Spice Powder, N.F.,* 30 p. c., + cinnam. 30, zingib. 20, capsic. 20. 4. *Pulv. Cret. Arom., N.F.,* 3 p. c.: Prep.: 1. *Pulv. Cret. et Opii Arom., N.F.,* 97.5 p. c. 5. *Pulv. Myric. Co., Composition Powder, N.F.,* 5 p. c. 6. *Syr. Senn. Arom., N.F.,* ⅖ p. c. 7. *Tr. Arom., N.F.,* 2 p. c.

MYRTACEÆ

8. *Tr. Opii Crocat., N.F.*, $\frac{3}{5}$ p. c. 9. *Tr. Viburn. Opul. Co., N.F.*, 5 p. c. OIL: 1. *Acet. Arom., N.F.*, $\frac{1}{10}$ p. c. 2. *Dentif., N.F.*, $\frac{1}{20}$ p. c. 3. *Fldglycer. Casc. Sagr. Arom., N.F.*, $\frac{1}{10}$ p. c. 4. *Lavat. Ori., N.F.*, 1 p. c. 5. *Liq. Pepsin, Arom., N.F.*, $\frac{1}{20}$ p. c. 6. *Nebul. Arom., N.F.*, $\frac{1}{5}$ p. c. 7. *Ol. Ricin. Arom., N.F.*, $\frac{1}{10}$ p. c. 8. *Sp. Card. Co., N.F.*, $\frac{1}{2}$ p. c. 9. *Syr. Eriodict. Arom., N.F.*, $\frac{1}{10}$ p. c. EUGENOL: 1. *Mist. Ol.-Balsam, N.F.*, $\frac{2}{5}$ p. c.

Unoff. Preps.: Infusion (Br.) 2.5 p. c., ℥ss–1 (15–30 cc.). *Inf. Aurant. Co.* (Br.), .5 p. c. *Tinct.*, 25 p. c. (Fr. alc.), ℥ss–1 (2–4 cc.).

PROPERTIES.—Stimulant, stomachic, carminative, antiemetic, aromatic, antispasmodic, rubefacient, germicide, antiseptic. Increases circulation, temperature, digestion, nutrition; excreted by kidneys, skin, liver, bronchi—stimulating and disinfecting each.

USES.—Nausea, vomiting, flatulence, colic, indigestion, condiment, corrective; externally in rheumatism, neuralgia, toothache (oil + oil of peppermint + chloral hydrate, āā q. s.), in liniments, etc.; spice powder (poultice)—over stomach to expel gas, relieve colic, on nape of neck for infantile convulsions.

Allied Plant:

1. *Eugenia Jambola'na, Jambul, Java Plum.*—E. Indies. Large tree producing edible fruit; all parts astringent, but seed and bark also arrest formation of sugar in diabetes; seed 1.2 Cm. ($\frac{1}{2}'$) long, a third as thick, oval, one end truncate, blackish-gray, hard, heavy, little odor and taste; capsules, fluidextract. Dose, gr. 5–10 (.3–.6 Gm.).

CAJUPUTUM. CAJUPUT.

Oleum Cajuputi. Oil of Cajuput, *U.S.P.*

Melaleuca Leucadendron, *Linné,* var. **Cajeputi,** var. **minor,** +. { The volatile oil distilled from the fresh leaves and twigs, and rectified by steam distillation.

Habitat. E. India Islands, Celebes, Bouro, Amboyna, Moluccas, Philippines, Cochin China, Australia.

Syn. Kayu-putu, White Tree (Wood), Pepperbark; Ol. Cajup., Cajuput Oil, Oil of Cajeput, Oleum Cajeputi; Fr. Huile (Essence) de Cajeput; Ger. Cajeputöl.

Mel-a-leu'ca. L. fr. Gr. μέλας, black + λευκός, white,—*i. e.*, bark of the trunk is blackish, that of the branches is whitish.

Leu-ca-den'dron. L. fr. Gr. λευκός, white, + δένδρον, a tree—*i. e.*, general appearance of the tree.

Caj-e-pu'ti (better **Caj-u-pu'ti**). L. fr. Malay, *kayu*, tree, + *putih*, white—*i. e.*, appearance of the branches.

Mi'nor. L. *minor, minus*, less, smaller—*i. e.*, plant smaller than other species, also smaller flower-heads and leaves.

PLANTS.—Small trees, 9–12 M. (30–40°) high; bark gray, brittle, splitting into thin layers; leaves 5–10 Cm. (2–4′) long, blade twisted, lanceolate; flowers 5–7.5 Cm. (2–3′) long, greenish to whitish, silky, pubescent, spikes; fruit woody, hard, sessile, dehiscing into 3 valves.

CONSTITUENTS.—Volatile oil, mucilage, pectin.

Oleum Cajuputi. Oil of Cajuput.—This oil, obtained by water or steam distillation, is a colorless, yellowish (greenish—usually due to copper) liquid, peculiar, agreeable, distinctly camphoraceous (cineol) odor, aromatic, slightly bitter taste, soluble in 1 vol. of 80 p. c. alcohol, sp. gr. 0.918, levorotatory; contains 50–67 p. c. of cineol (cajuputol, eucalyptol), $C_{10}H_{18}O$, also the alcohol terpineol, $C_{10}H_{17}OH$, several terpenes—*l*-pinene, etc., valeric and benzoic aldehydes, which upon oxidation impart acid reaction. It is imported mostly from Celebes (Macassar), Bouro (islands), some from Singapore, Java, Manila, in emptied beer and wine bottles, 25 packed in a crate, or in copper cans (rare). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–10 (.13–.6 cc.), emulsion, pill, on sugar; externally in liniments.

FIG. 278.—*Melaleuca Leucadendron* var. *Cajeputi*—small branches with leaves, buds, and flowers; *1*, vertical section of fruit; *2*, transverse section of ovary; *3*, vertical section of flower.

ADULTERATIONS.—Copper from shipping cans (rare), many cheaper oils, as camphor, rosemary, turpentine (French turpentine, owing to its *l*-pinene, being difficult to detect), also these sometimes colored with resin of milfoil, all rendering action with iodine more violent.

PREPARATION.—(Unoff.): *Spiritus Cajuputi* (Br.), 10 p. c., dose, ♏v–20 (.3–1.3 cc.).

PROPERTIES.—Same as oil of clove; carminative, stimulant, diaphoretic, vermifuge, parasiticide, rubefacient, counter-irritant.

USES.—Rheumatism, myalgia, spasmodic affections of the stomach and bowels, catarrh of bladder, low fevers, gout, colic, cholera morbus, dysmenorrhea, laryngitis, bronchitis, toothache, chilblains.

Allied Plants:

1. *Pimen'ta officina'lis*, *Pimenta*, *Allspice*, *N. F.*—The dried, nearly ripe fruit with not more than 3 p. c. of foreign organic matter nor .4 p. c. of acid-insoluble ash; C. and S. America, W. Indies, cultivated. Handsome evergreen tree, 9–12 M. (30–40°) high; bark smooth, gray; leaves 10–15 Cm. (4–6′) long, oval-oblong, entire, bright green, pellucid-punctate; flowers white. Fruit, subglobular, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{4}$′) broad,

apex with 4 calyx teeth, dark brown, glandular-punctate, pericarp brittle 1 Mm. ($\frac{1}{25}'$) thick, 2-celled, each cell 1-seeded; odor and taste, particularly the pericarp, aromatic, distinctive. Powder, dark brown —numerous starch grains with central cleft, many stone cells with lumina often filled with yellowish amorphous substance, oil secretion reservoirs with oil, parenchyma cells with tannin masses; stem fragments few, characterized by non-glandular hairs, calcium oxalate rosettes, tracheid-like wood tissues and long bast-fibers; yield of crude fiber does not exceed 25 p. c.; solvents: alcohol extracts the virtues, water absorbs the flavor, and, if hot, some constituents; contains volatile oil 3–4 p. c., resin, fixed oil 6–8 p. c., tannin, sugar, gum, ash 6 p. c. Dose, gr. 5–30 (.3–2 Gm.).

Fig. 279.—*Pimenta officinalis* (*Pimenta*).

Oleum Pimentæ, Pimento Oil, Oil of Pimenta (*Allspice*), *N.F.*—This volatile oil distilled from the fruit, yielding not less than 65 p. c., by volume, of eugenol, comes over in two fractions mixed together, one light, the other heavy; it is a colorless, yellow, or reddish liquid, darker with age, characteristic odor and taste of allspice; soluble (clear) in equal volume of 90 p. c. alcohol, in 2 vols. of 70 p. c. alcohol, sp. gr. 1.033, levorotatory. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.). Fruit: 1. *Tinctura Guaiaci Composita*, 3.2 p. c. (diluted alcohol). *Water*—25 Gm. + water 1000, distil 500 cc.; *Infusion*, 5 p. c. Oil: 1. *Liquor Pepsini Aromaticus*, $\frac{1}{40}$ p. c. 2. *Spiritus Myrciæ Compositus*, $\frac{1}{20}$ p. c. Stomachic, carminative, condiment; flatulency, nausea, intestinal colic, corrective to griping purgatives—similar to clove.

2. *Pimenta acris, Myrcia, Bay, Wild Clove; Oleum Myrciæ, Oil of Bay, N.F.*—The volatile oil distilled from the leaves; W. Indies, Jamaica, cultivated. Tree, beautiful, fragrant, 9–12 M. (30–40°) high; leaves 5–8 Cm. (2–3′) long, oval, coriaceous, pellucid-punctate, exhaling aroma when bruised similar to clove (volatile oil); flowers small, white with red tinge; fruit globular berry, size of a pea, blackish, resembling allspice; contains volatile oil, tannin. Oleum Myrciæ, is a yellowish liquid, pleasant aromatic odor, pungent, spicy taste, with equal volume of alcohol (acid reaction), acetic acid, or carbon disulphide—slightly turbid solutions, sp. gr. 0.976, levorotatory; contains eugenol 65 p. c., chavicol, myrcene, phellandrene, citral. *Impurities:*

Oil of pimenta, oil of clove, phenol. Should be kept cool, dark, in small well-stoppered, amber-colored bottles. Astringent, tonic, stimulant, perfume; nervous headache, faintness, chafing, hair washes, perfumery; 1. *Spiritus Myrciæ Compositus, Bay Rum*, $\frac{4}{5}$ p. c., + oil of orange, oil of pimenta, āā, $\frac{1}{20}$ p. c., alcohol 61, water q. s. 100; better grades made by distilling leaves with St. Croix rum (Jamaica, imported bay rum).

EUCALYPTUS. EUCALYPTUS, *U.S.P.*

Eucalyptus globulus, *Labillardière.* { The dried scythe-shaped leaf, with not more than 3 p. c. of stems, fruits, or other foreign organic matter.

Habitat. Australia (Tasmania, Victoria); cultivated in subtropics, Europe, N. Africa, S. United States (California, Florida, etc.); rich valleys, moist slopes of wooded hills.

Syn. Eucalypt., Blue Gum Leaves, Gum Tree (Wood), Fever Tree of Australia, Blue Gum-tree, Woolly Butt, Iron Bark Tree; Fr. Feuilles d'Eucalyptus; Ger. Eucalyptus-blätter.

Eu-ca-lyp'tus. L. fr. Gr. *εὖ*, well, good, + *καλυπτός*, covered—*i. e.*, the calyx-limb covers the flower bud before expansion and afterward, at anthesis, falls off in the shape of a lid or cover—the outer operculum of the bud (not the inner of united petals).

Glob'u-lus. L. *globulus, globulosus*, a little ball, globular—*i. e.*, the thick button-like form of the fruit.

Plant.—Rapid-growing tree, 60–90 M. (200–300°) high, 3–6 M. (10–20°) thick (the largest being 141 M. (470°) high, 27 M. (87°) in circumference—*E. amygdalina*); bark ash-color; flowers Nov.–Dec., hermaphrodite, pedunculate, pinkish-white, buds very glaucous, consisting of calyx-tube covered by conical lid (operculum) of calyx-limb and united petals, fruit capsules, 18 Mm. ($\frac{3}{4}'$) broad, half-globular, 4–5-ribbed, dehiscing at apex, many-seeded. Leaves (Leaf)—Blades lanceolate, curved, 8–30 Cm. (3–12′) long, 2–7.5 Cm. ($\frac{4}{5}$–3′) broad, acute, base unequal, rounded; petiole twisted, 5–35 Mm. ($\frac{1}{5}$–$1\frac{2}{5}'$) long; margin uneven, revolute, coriaceous, both surfaces pale yellowish-green, glaucous, glandular-punctate, numerous small circular brown dots of cork; veins of the first order anastomosing to form a vein nearly parallel with margin; stomata deeply depressed (level or elevated in spurious leaves); odor aromatic, taste aromatic, bitter, cooling. Powder, light green—fragments of epidermis with stomata nearly invisible, chlorenchyma with broken oil reservoirs, brownish cork, bast-fibers, tracheæ, calcium oxalate in rosette aggregates. *Solvents:* diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Gm.).

Adulterations.—Leaves: Various leaves having stomata level with leaf-surface, not deeply depressed as in genuine; Powder: Should not reveal epidermal fragments with guard-cells of stomata visible upon vertical view, nor should any fragments, without stomata, exhibit wavy epidermal cells upon vertical view; Oil: Oils of various

species of Eucalyptus containing much phellandrene, castor oil 12–20 p. c.

Commercial.—The blue-gum tree of Tasmania (exuding blue-gum), discovered by Labillardière, French botanist, 1792, and introduced into Europe, 1856, is sensitive to cold, but under favorable conditions attains the height of 15 M. (50°) in 6 years; there are 135 species,

FIG. 280.—*Eucalyptus globulus: a, b,* leaves from old twig; *c,* from young twig.

the wood of many being hard, resinous and valuable. The aborigines knew something of its virtues, while the Spaniards used it for fever and ague, 1867, but Drs. Brunel and Ramel extolled and proved its antiperiodic properties, 1868–1869. Leaves are picked, dried carefully, and enter trade very little broken, those that are ovate, equilateral, thin and sessile, "junior," being rejected; only the Australian variety

should be used, as they vary less in the yield of oil; however, most of our supply comes from California.

CONSTITUENTS.—Volatile oil 6 p. c., tannin, cerylic alcohol, 3 resins (1 acid, crystallizable), eucalyptic acid.

Oleum Eucalypti. Oil of Eucalyptus, *U.S.P.*—(Syn., Ol. Eucalypt., Eucalyptus Oil; Fr. Essence d'Eucalyptus; Ger. Eukalyptusöl.) This volatile oil, distilled from the fresh leaves (old leaves containing very little oil) of this and other species, is a neutral, colorless, pale yellow liquid, characteristic, aromatic, somewhat little camphoraceous odor, pungent, spicy, cooling taste, soluble in 4 vols. of 70 p. c. alcohol, sp. gr. 0.915, dextrorotatory; congeals at not below −15.4° C. (4° F.); contains at least 70 p. c. of eucalyptol (cineol), $C_{10}H_{18}O$, 20 p. c. of cymene, $C_{10}H_{14}$, eudesmol, $C_{10}H_{16}O$, phellandrene, $C_{10}H_{16}$, eucalyptene, $C_{10}H_{18}$, terpene—*d*-pinene (small amount), $C_{10}H_{14}$, also a little valeric, butyric and capronic aldehydes; with hydrochloric acid yields eucalypteol (eucalyptene hydrochloride), $C_{10}H_{16}.2HCl$, in white hygroscopic, aromatic crystals; with phosphoric oxide yields eucalyptolene, thickish liquid. *Tests:* 1. Mix oil (2) with glacial acetic acid (4), add 20 p. c. aqueous solution of sodium nitrite (3), stir gently—no crystals of phellandrene nitrite (abs. of other eucalyptus oils containing much phellandrene). *Impurities:* Castor oil 12–20 p. c., etc. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ℥v–15 (.3–1 cc.).

Eucalyptol. Eucalyptol, $C_{10}H_{18}O$, *U.S.P.*—(Syn., Cineol, Cajuputol; Fr. Eucalyptol, Oxyde de Terpilène; Ger. Eucalyptolum, Eukalyptol, Zineol.) This substance obtained from oil of eucalyptus and other sources (cajuput, canella, curcuma, laurus, mentha, rosemary, salvia, santonica) is the most valuable constituent of eucalyptus oil, being neutral and with a definite chemical composition, which is not true of the oil, and may be obtained by distilling the volatile oil and placing in a freezing mixture that portion coming over between 150–176° C. (302–347° F.), from which it crystallizes in long, colorless needles; a more satisfactory method is to treat the oil with hydrochloric acid gas or phosphoric acid, add warm water to separate eucalyptol on the surface, then wash with dilute alkali solution and distil. It is a colorless liquid, characteristic, aromatic, distinctly camphoraceous odor, pungent, spicy taste; slightly soluble in water, miscible with alcohol, chloroform, ether, glacial acetic acid, fixed or volatile oils, sp. gr. 0.922, boils at 176° C. (349° F.), congeals at 0° C. (32° F.). *Tests:* 1. Optically inactive (dist. from oil of eucalyptus, many other volatile oils); alcoholic solution (1 in 10) —neutral. 2. Place 1 cc. in freezing mixture, add gradually phosphoric acid (1)—solid, white, crystalline mass (eucalyptol-phosphoric acid), + warm water—eucalyptol separates. 3. Shake 5 cc. with sodium hydroxide T. S. (5)—eucalyptol volume not diminished (abs. of phenols, etc.). 4. Shake 1 cc. with distilled water (20), after liquids separate, add to aqueous layer 1 drop ferric chloride T. S.—no violet color (abs. of phenols). *Impurities:* Oil of eucalyptus, volatile oils, saponifiable oils, phenols. Dose, ℥v–15 (.3–1 cc.).

MRYTACEÆ

PREPARATIONS.—LEAVES: 1. *Fluidextractum Eucalypti.* Fluidextract of Eucalyptus. (Syn., Fldext. Eucalypt., Fluid Extract of Eucalyptus; Fr. Extrait fluide d'Eucalyptus; Ger. Eucalyptusfluidextrakt.)

Manufacture: Similar to Fluidextractum Sarsaparillæ, page 126; menstruum: 75 p. c. alcohol, reserve first 80 cc. Dose, ♏xv–60 (1–4 cc.). OIL: 1. *Curatio Paraffini, N.F.,* 2 p. c. EUCALYPTOL: 1. *Nebula Eucalyptolis, N.F.,* 5 p. c., + light-liquid petrolatum 95. 2. *Petroxolinum Eucalyptolis, N.F.,* 20 cc. in 100 cc. product. 3. *Liquor Antisepticus, N.F.,* ½ p. c. 4. *Liquor Aromaticus Alkalinus, N.F.,* $\frac{1}{10}$ p. c. 5. *Liquor Pepsini Antisepticus, N.F.,* $\frac{1}{20}$ p. c. 6. *Nebula Aromatica, N.F.,* ⅕ p. c. 7. *Nebula Mentholis Composita, N.F.,* ⅕ p. c. 8. *Petroxolinum Sulphuratum Compositum, N.F.,* 3 cc. in 100 cc. product. 9. *Pulvis Antisepticus, N.F.,* $\frac{1}{10}$ p. c.

Unoff. Preps.: LEAVES: *Extract,* gr. 2–10 (.13–.6 Gm.). *Infusion,* ʒj–2 (30–60 cc.). *Tincture,* 15 p. c., ʒss–2 (2–8 cc.). OIL: *Unguentum Eucalypti* (Br.), 10 p. c. *Water* (*Aqua*), ʒj–4 (4–15 cc.).

PROPERTIES.—Antiperiodic, antipyretic, expectorant, stimulant, astringent, antiseptic, disinfectant, diaphoretic; like quinine arrests white blood corpuscle movement; increases flow of saliva, gastric juice, heart action, appetite, digestion; large doses produce indigestion, diarrhea, vomiting, muscular weakness, low temperature, renal and cerebral congestion, paralyzed respiration, death; destroys low forms of life, reduces arterial tension and enlarged spleen. It antagonizes malaria thus: 1, its dead leaves elevate the low moist soil; 2, being a rapid grower, its leaves, roots, etc., absorb much malarial soil-water and noxious germs, thus causing the surrounding country to become dry, thereby purifying the atmosphere; 3, its enormous foliage protects large areas from direct sun-rays which favor the generation of animalculæ; 4, its aseptic emanations purify the air. Owing to these properties it is cultivated largely in malarial districts, to render them sanitative, and to reclaim infected localities, as portions of Australia, Jamaica, Roman Campagna, etc. It is eliminated by skin, bronchia, kidneys, lungs, with more or less irritation, imparting odor to breath and urine.

USES.—Intermittent fever, genito-urinary and pulmonary catarrh, chronic bronchitis, mucous membrane affections, asthma (smoked with stramonium). Used when quinine is contra-indicated, intermittents, typhoid, scarlatina, whooping-cough, cancer, hemorrhages; externally —as antiseptic in ulcers, gonorrhea, spongy gums, gleet, deodorizer in diseases with disagreeable odor, preventive of putrefaction; spray beneficial in diphtheria, gangrene of lungs, fetid bronchitis. Tincture (1) added to cod-liver oil (100) removes fishy flavor; the leaves deter moths entering woolen cloth; bark used for tanning, dyeing.

Incompatibles: Agents aiding waste, alkalies, mineral acids, salts.

Synergists: Aromatic bitters, antispasmodics, copaiba, cubeb, oil of turpentine, etc.

Bosisto found the yield of volatile oil from 100 pounds (45.5 Kg.) of leaves from each of the several species to vary considerably: *E.*

globulus—12 ounces (.3 L.), the only one having eucalyptol to an appreciable extent, *E. amygdali'na, Peppermint Tree*—50 ounces (1.5 L.); *E. dumo'sa*—30 ounces (.9 L.); *E. obli'qua, Stringy-bark Tree*—8 ounces (.2 L.); *E. Leucox'ylon* (*Siderox'ylon, Iron-bark Tree*—16 ounces (.5 L.); *E. oleo'sa, Mallee Tree*—20 ounces (.6 L.).

Allied Plants:

1. *Eucalyptus rostra'ta; Eucalyptus Gummi, Eucalyptus Gum* (*Kino*), *Red Gum, N.F.*—A dried gummy exudation from the bark of this and other species; Australia. Many species (50), all large trees, yield this product from cavities and hand-made incisions, when it is dried by artificial heat—the yield per tree about the same as of ordinary kino. It is in reddish-brown grains, angular masses, in thin layers transparent ruby-red; brittle, forming plastic mass adhering to teeth when chewed, coloring saliva red; odor slight, taste very astringent. Powder, dark reddish-brown—angular fragments with conchoidal fracture, thinner pieces yellowish-brown; aqueous solution faintly acid, reddish—intensified by an alkali; diluted solution + ferric chloride T. S.—dark green color, more concentrated—dark green precipitate; almost completely soluble in alcohol without becoming plastic; 80–90 p. c. soluble in water, solubility lessens with age; contains kino-tannic acid 45–50 p. c., kino-red, catechin, pyrocatechin, volatile oil, ash 2 p. c. Properties and Uses: similar to kino. Dose, gr. 5–15 (.3–1 Gm.); 1. *Trochisci Eucalypti Gummi*, 1 gr. (.06 Gm.), + tragacanth 1 gr., acacia 2 gr., sucrose 6 gr., oil of orange $\frac{1}{20}$ ♏., fldext. rose $\frac{1}{2}$ ♏.

2. *Ara'lia racemo'sa, Aralia, American Spikenard, Spignet, N.F.*—Araliaceæ. The dried rhizome and roots with not more than 5 p. c. of stem-bases or other foreign organic matter; United States, Georgia to Canada, west to Rocky Mountains. Large perennial herb, 1 M. (40′) high, branched, leaflets ovate, cordate, serrate; flowers small, greenish-yellow. Rhizome, 12 Cm. (5′) long, 5 Cm. (2′) thick, scaly, pale brown, internally whitish, frequently cut longitudinally, nodes approximate, prominent stem-scars, 3 Cm. ($1\frac{1}{5}$′) broad, fracture fibrous; roots numerous, .5–.7 M. (20–30′) long, 5–25 Mm. ($\frac{1}{5}$–1′) thick; odor aromatic, taste mucilaginous, pungent, slightly acrid, Powder, yellowish—starch grains, calcium oxalate rosettes, tracheæ, lignified cells with walls showing simple pores (dist. fr. *A. nudicaulis*); solvent: diluted alcohol; contains resin, volatile oil, starch, pectin. Stimulant, diaphoretic, alterative; syphilis, chronic rheumatism and cutaneous affections; locally to sluggish ulcers. Dose, gr. 30–60 (2–4 Gm.); 1. *Fluidextractum Araliæ*, (67 p. c. alcohol), dose, ℥ss–1 (2–4 cc.).

3. *Ara'lia spino'sa, Hercules' Club, Prickly Elder.*—The bark, U.S.P. 1820–1870; East and west N. America. Prickly tree, 3–9 M. (10–30°) high, leaflets crowded at summit; flowers white; bark in quills, curves, gray, prickly, inside yellowish, aromatic, acrid; contains araliin, volatile oil, resin. Stimulant, diaphoretic, demulcent (emetic, cathartic), alterative; rheumatism, skin eruptions, syphilis, colic, dyspepsia, toothache, vomiting, nervousness; externally antidote to rattlesnake-

MYRTACEÆ

bites; in infusion, decoction, tincture, masticatory. Dose, gr. 30–60 (2–4 Gm.).

4. *A. nudicau'lis, Wild, Virginian, False Sarsaparilla.*—The root (rhizome), U.S.P. 1820–1870; N. America. Small shrub, stem scarcely above ground, leaf single, petiole .3 M. (1°) high; leaflets ovate, serrate, flowers greenish. Root .3 M. (1°) long, 5 Mm. ($\frac{1}{5}'$) thick, annulate, brownish-gray, inside whitish, spongy pith, aromatic odor and taste; contains volatile oil, resin, starch. Stimulant, diaphoretic,

FIG. 281.—*Panax (Aralia) quinquefolium.*

alterative—like sarsaparilla, in infusion, decoction. Dose, gr. 30–60 (2–4 Gm.).

5. *Pa'nax quinquefo'lium* (*Aralia quinquefo'lia*), *Panax, Ginseng.*—The root, U.S.P. 1840–1870; N. America. Small shrub, .3 M. (1°) high, smooth, leaflets 5's, serrate; flowers yellowish, fruit scarlet; root 5–12.5 Cm. (2–5′) long, fusiform, annulate, branched, brownish-yellow, wood yellowish, sweetish, aromatic; contains panaquilon, resin, volatile oil, starch, gum. Stimulant, demulcent, stomachic; infusion, decoction,

tincture. The *Chinese Ginseng* (*Aralia Gin'seng*) is very similar to this, slightly larger. Used natively as nervine, aphrodisiac. Dose, ʒss–2 (2–8 Gm.).

51. UMBELLIFERÆ. Parsley (Carrot) Family.

Um-bel-lif'-e-re. L. *Umbelliferæ—umbrella*, umbel, + *ferre*, to bear —*i. e.*, flowers borne in umbels. Herbs, shrubs. Distinguished by possessing aromatic, stimulant volatile oils; flowers in umbels; stems hollow; leaves usually compound; fruit cremocarp, with vittæ (oil-tubes), indehiscent; calyx adnate to ovary; petals and stamens 5, inserted on fleshy epigynous disk; ovary 2-celled, inferior; seeds 1 in each carpel, albumen horny; temperate climates; aromatic, carminative, stimulant, tonic (vol. oil), narcotic, poisonous (acrid juice), antispasmodic (gum-resin).

Genera: **1. Coriandrum. 2. Carum. 3. Pimpinella. 4. Fœniculum. 5. Ferula.**

CORIANDRUM. CORIANDER, *N.F.*

Oleum Coriandri. Oil of Coriander, *U.S.P.*

Coriandrum sativum, *Linné.* { The volatile oil distilled from the dried ripe fruit.

Habitat. C. Asia, S. Europe (China, Italy; cultivated in the United States, Europe).

Syn. Coriand., Coriander Seed, Coliander; Br. Coriandri Fructus; Fr. Coriandre; Ger. Koriander(samen); Ol. Coriand., Coriander Oil; Fr. Essence de Coriandre; Ger. Korianderöl.

Co-ri-an'drum. L. fr. Gr. κόρις, a bed-bug—*i. e.*, from a resemblance in odor of the leaves, also the entire plant and fruit when young.

Sa-ti'vum. L. *sativus*, sown, cultivated—*i. e.*, kind used, in contradistinction to the wild-grown.

Plant.—Annual herb, odor of bed-bugs; stem .3–.6 M. (1–2°) high, solid; leaves bi- or tripinnate; leaflets linear, pointed, lobed, light green, resembling parsley; flowers June, white, rose-colored, umbels small, 4 Cm. ($1\frac{3}{5}'$) broad, 5–8-rayed. Fruit—Coriandrum, Coriander (Seed), *N.F.*—The dried ripe fruit with not more than 5 p. c. of other fruits, seeds, or other foreign organic matter, yielding not more than 1.5 p. c. of acid-insoluble ash, nor less than .5 p. c. of volatile ether-soluble extractive; mericarps usually coherent, but easily separated, cremocarp nearly globular, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}'$) broad, yellowish-brown, apex with 5 calyx teeth and short stylopodium; mericarps 2, each with 5 prominent, straight primary ribs and 4 distinct secondary ribs; commissural surface deeply concave with 2 vittæ; odor and taste agreeably aromatic. Powder, light brown—chiefly endosperm and lignified tissues of pericarp, many calcium oxalate crystals in rosettes,

aleurone grains, numerous globules of fixed oil, yellow oil tubes (vittæ); solvents: alcohol, water partially. Dose, gr. 10–30 (.6–2 Gm.).

CONSTITUENTS.—Volatile oil .5–1 p. c., fat 13 p. c., tannin, malic acid, mucilage, ash 7 p. c.

Oleum Coriandri. Oil of Coriander.—This volatile oil, distilled with water or steam from the dried ripe fruit crushed between rollers, is a colorless, pale yellow liquid, characteristic odor and taste of coriander, soluble in 3 vols. of 70 p. c. alcohol, sp. gr. 0.870, dextrorotatory; contains a terpene—*d*-pinene, $C_{10}H_{16}$, 5 p. c., geraniol, borneol, and an alcohol—linalool (coriandrol), $C_{10}H_{18}O$, 45–90 p. c., from which 1 molecule of H_2O may be withdrawn, leaving $C_{10}H_{16}$. Should meet the requirements of the tests for heavy metals in volatile oils and be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 cc.).

ADULTERATIONS.—FRUIT: Stems, fragments of leaves; OIL: Oils of turpentine, sweet orange, cubeb and cedar-wood—all recognized by being less soluble in 70 p. c. alcohol.

FIG. 282.—Coriandrum: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

Commercial.—Coriander was popular with the ancients; in the fresh state all parts upon being bruised are fetid, the fruit becoming fragrant only upon drying; when ripe plants are cut down with sickles, dried, and fruit thrashed out. Russia produces the bulk of the crop, although we grow mostly our home consumption; that from Bombay (Indian) is larger and ovoid but seldom reaches the United States.

PREPARATIONS.—OIL: 1. *Fluidextractum Cascaræ Sagradæ Aromaticum*, $\frac{1}{100}$ p. c. 2. *Spiritus Aurantii Compositus*, 2 p. c. 3. *Syrupus Sennæ*, ½ p. c. 4. *Confectio Sennæ, N.F.*, ½ p. c. 5. *Emulsa*, as preferred. FRUIT: 1. *Fluidextractum Stillingiæ Compositum, N.F.*, 6.3 p. c. 2. *Infusum Gentianæ Compositum, N.F.*, ⅘ p. c. *Fluidextract*, ♏xv–30 (1–2 cc.). *Infusion*, 5 p. c., ℥j–2 (30–60 cc.).

PROPERTIES.—Aromatic, carminative, stimulant, stomachic.

USES.—Indigestion, flatulency, corrective to griping medicines, such as senna, rhubarb, jalap; flavoring to gin and in cooking. Oil also used in colic, rheumatism, neuralgia.

Allied Plants:

1. *Coni'um macula'tum, Conium, Poison Hemlock, N.F.*—The dried full-grown, but unripe fruit with not more than 2 p. c. of foreign fruits, seeds, or other foreign organic matter, yielding not less than .5 p. c. of coniine; it is unfit for use when kept for more than 2 years, and should be carefully dried and preserved; Europe, Asia, N. Africa, naturalized in N. and S. America—waste places. Large branching herb, 2–2.5 M. (6–8°) high, stem furrowed, hollow, smooth, green, mottled with port-wine-colored spots; root biennial, fusiform, 15 Mm. (⅗′) thick, exuding milky juice when cut; flowers white, small umbels;

leaves bi-pinnate, 15–30 Cm. (6–12′) long, incised, dentate, mucronate, grayish-green on drying. Fruit, cremocarp, broadly oval, greenish-gray, 2 mericarps often separated, each 3 Mm. ($\frac{1}{8}$′) long, 1.5 Mm. ($\frac{1}{16}$′) broad, ovoid; inner flattened side with deep longitudinal groove, outer

Fig. 283.—*Conium maculatum.*

convex with 5 pale yellow crenate ribs, pericarp without oil tubes; odor slight, but with solution potassium hydroxide T. S. strongly disagreeable, mouse-like; taste characteristic, disagreeable, acrid. Powder, greenish-gray—endosperm tissue, parenchyma cells containing fixed oil, aleurone grains, calcium oxalate rosettes, lignified fibers, seed-coat fragments, starch grains, tracheæ; solvent: alcohol; contains coniine (conine—liquid) .5–1.5 p. c., methylconiine, conhydrine, pseudoconhydrine, volatile oil, fixed oil, coniic acid, ash 8 p. c. Sedative, narcotic, anodyne, soporific, antispasmodic, anaphrodisiac; depresses all motor nerves, beginning in peripheries, thence to spinal cord, etc., causing motor paralysis without loss of sensation; spasmodic chorea, whooping-cough, melancholia, neuralgia, delirium tremens, tetanus, asthma, epilepsy,

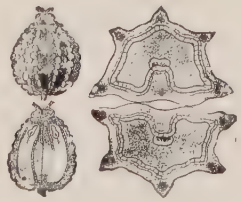


Fig. 284.—Conium: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

pneumonia; scrofulous glandular sores, affections of mammary glands, to check milk secretion, etc. *Poisoning:* Vomiting, fatigue, heaviness of legs, numbness, drooped eyelids, mydriasis, vertigo, impaired speech, slow pulse, paralysis of voluntary muscles, loss of speech, and vision, death from paralysis of respiratory muscles—emetics, lavage, tannin, strychnine, diffusible stimulants, atropine, warmth, epispastics, artificial respiration. Dose, gr. 1–5 (.06–.3 Gm.); 1. *Extractum Conii* (diluted alcohol + .3 p. c. of diluted hydrochloric acid), dose, gr. ½–2 (.03–.13 Gm.). *Fluidextract* (diluted alcohol + 2 p. c. of acetic acid), ♏j–5 (.06–.3 cc.); Ointment; Tincture.

2. *Ap'ium grave'olens, Apii Fructus, Celery Fruit (Seed), N.F.*—The dried ripe fruit with not more than 5 p. c. of unsound or foreign fruits or other foreign organic matter, yielding not more than 3 p. c. of acid-insoluble ash; S. Europe, cultivated. Biennial herb; root fusiform, white—when wild, poisonous, under cultivation, harmless; blanched stalks popular as a salad. Fruit, mericarps 2, united or separate, ovoid, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) long, dark brown; inner surface flat, outer convex, with 5 slender ribs, 2 being marginal; odor characteristic, agreeable; taste aromatic, warm, pungent. Powder, brown, oily—pericarp fragments with yellowish oil tubes, brown secretion cells and few epidermal papillæ; tracheæ, fibers, aleurone grains, calcium oxalate rosettes; solvent: alcohol; contains volatile oil 2–3 p. c., fixed oil, ash 3–8 p. c. Carminative, stimulant, nervous sedative, flavoring (infusion, juice); bronchitis, intermittents, contusions, swollen glands. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Apii Fructus* (alcohol), dose, ♏xv–30 (1–2 cc.): Prep.: 1. *Elixir Guaranæ et Apii*, 15 p. c.

Fig. 285.—*Apium (Carum—Petroselinum) graveolens:* pinnate leaf.

3. *Eryn'gium aquat'icum (yuccæfo'lium), Button Snakeroot.*—The root, U.S.P. 1820–1860; United States. Plant .6–1.8 M. (2–6°) high, leaves rigid, pointed, .3–1 M. (1–3°) long, bristly; flowers white; root tuberous, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) long, branched, cup-shaped scars, central pith, aromatic; taste sweet, acrid, aromatic, resembles parsnip; contains volatile oil. Diaphoretic, expectorant, sialagogue, emetic; dropsy, gravel, jaundice, substitute for senega; infusion, decoction, tincture. Dose, ʒss–1 (2–4 Gm.).

4. *Petroseli'num sati'vum, Petroselinum, Parsley Fruit*, U.S.P. 1910.—The dried ripe fruit with not more than 5 p. c. of foreign seeds and other matter; S. Europe, Asia Minor, United States, cultivated in gardens universally. Annual herb, .6–1.2 M. (2–4°) high, stem furrowed, jointed; root biennial, conical 15 Cm. (6′) long, 12 Mm. (½′)

thick, annulate, yellowish. Fruit, cremocarp, ovoid-crescent-shaped, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) long, grayish-brown, brownish on aging, mericarps 2, separate, each with 5 filiform prominent ribs, commissural surface with 2 vittæ, dorsal 1–2 vittæ, endosperm large, oily; odor and taste characteristic, aromatic, especially when bruised; solvents: alcohol, water partially; contains volatile oil 5–6 p. c., apiol (white crystals), resin, fixed oil, 12 p. c., cariol, apiin, apiolin (greenish liquid), tannin, mucilage, ash 7 p. c. Diuretic, stimulant, emmenagogue, carminative, antiperiodic, insecticide, germicide; nephritis, cystitis, dropsy, amenorrhea, dysmenorrhea (beginning 3–4 days before the molimen); fresh juice in intermittents; root used similarly. Dose, gr. 10–30 (.6–2 Gm.). *Apiol*, gr. 3–8 (.2–.5 Gm.); *Oleoresin*, ♏v–15 (.3–1 cc.).

Fig. 286.—*Æthusa Cynapium.*

5. *Æthu'sa Cyna'pium, Fool's Parsley, Small Hemlock.*—Leaves nonpoisonous, and sometimes carelessly mixed with those of conium—the plants, however, being distinguished easily, as *Æthusa Cynapium* has leaves of different shape, darker color, leek-like odor; occasionally have mixed also the pubescent ciliate leaflets of several species of *Chærophyl'lum.*

CARUM. CARAWAY, *U.S.P.*

Carum Carvi (Carui), *Linné.* — The dried ripe fruit, with not more than 3 p. c. of other fruits, seeds or foreign organic matter, yielding not more than 1.5 p. c. acid-insoluble ash.

Habitat. C. and W. Asia, Himalayas, Caucasus, Europe, Siberia; cultivated in England, Norway, Russia, Germany, Holland, Morocco, United States.

Syn. Caraway Seed (Fruit), Carawayseed, Carvies; Br. Carui Fructus; Fr. Carui, Carvi, Cumin des Prés; Ger. Fructus Carvi, Kümmel, Gemeiner Kümmel.

Ca'rum. L. *careum*, fr. Gr. κάρον, after Caria, in Asia Minor—*i. e.*, its original habitat. *Carui* was the name used by medieval pharmacists for the drug.

Car'vi. L. for *carvy, carvey.* Ar. *karawya*, Eng. caraway. Here frequently the word *Carui* is used, thus assimilating L. gen., as though for *Carui Semina.*

Plant.—Biennial herb; stem .3–1 M. (1–3°) high, hollow; leaves bi- or tripinnate, deeply incised; flowers May–June, small, white, no involucre; root fleshy, fusiform, white. Fruit, cremocarp, usually in 2 separated mericarps; curved, tapering, toward both ends, 3–7 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) long, 2 Mm. ($\frac{1}{12}$′) broad, dark brown, 5 yellow filiform ribs, dorsal surface 4 vittæ, commissural surface 2, endosperm large, oily; odor and taste aromatic. Powder, yellowish-brown—outer epidermal

cells characterized by a waviness and striping of the cuticle; endosperm cells containing aleurone grains with the embedded rosette aggregates; tracheæ, lignified fibers, oil tubes. *Solvents:* alcohol; water partially. Dose, gr. 10–30 (.6–2 Gm.).

Fig. 287. — *Carum Carvi* (*Carui*): flower, fruit, and cross-section of fruit, enlarged.

Adulterations.—Allied and occasionally exhausted (drawn) fruits — having shriveled appearance; seeds of weeds—usually yielding starch in the powder; dirt—showing excess of ash.

Commercial.—Fruit ripens in the 2d year, August, when the plant is cut down, dried, and thrashed on cloth. There are five varieties: 1, *Holland* (*Dutch*), finest; 2, *German;* 3, *English*, shortest; 4, *Mogador*, longest, lightest; 5, *American*, the result of home cultivation in gardens, being quite aromatic but smaller than the German, these two constituting nearly our total supply; yield 8–10 hundred-weight per acre; root, resembling that of parsnip, is employed as food in N. Europe.

Constituents.—Volatile oil 5–7 p. c., fixed oil, resin, tannin, sugar, gum, ash 5–8 p. c.; no starch.

Oleum Cari. Oil of Caraway, *U.S.P.*—(Syn., Ol. Cari., Caraway Oil; Br. Oleum Carui; Fr. Essence de Carvi; Ger. Oleum Carvi, Kümmelöl, Carvon.) This volatile oil, obtained by steam distillation from the dried ripe fruit, should yield not less than 50 p. c. of carvone, and is a colorless, pale yellow liquid, characteristic odor and taste, soluble in 8 vols. of 80 p. c. alcohol, sp. gr. 0.905, dextrorotatory; contains a ketone—carvone (*d*-carvone, carvol), $C_{10}H_{14}O$, at least 50 (50–65) p. c., a terpene—carvene (*d*-carvene, citrene, hesperidene, *d*-limonene), $C_{10}H_{16}$, 35–50 p. c., and an alcohol, $C_{10}H_{17}OH$, etc. Carvone may be obtained by treating the oil with alcoholic solution of ammonium sulphide, decomposing the resulting crystals with potassium hydroxide; it is a viscid, yellowish, oily liquid, creosote odor and taste, closely related to menthol and myristicol, identical with thymol, cuminic alcohol and carvacrol, this latter being the product of distilling a mixture of caraway oil and potassium or sodium hydroxide (thus expelling carvene), decomposing residue with sulphuric acid, rectifying; useful in toothache, by inserting it into cavity. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 cc.).

Fig. 288. — Carum: fruit and longitudinal section, 3 diam.; transverse section, 8 diam.

PREPARATIONS.—FRUIT: 1, *Tinctura Cardamomi Composita*, 1.2 p. c. OIL: 1. *Mistura Carminativa, N.F.*, $\frac{1}{20}$ p. c. 2. *Spiritus Cardamomi Compositus, N.F.*, $\frac{1}{20}$ p. c.

Unoff. Preps.: FRUIT: *Fluidextract*, ♏x–30 (.6–2 cc.). *Infusion*, 5 p. c., ℥j–2 (30–60 cc.). *Water* (Br.), 100 Gm. + water 2000 cc., distil 1000 cc. OIL: *Spirit.*

PROPERTIES.—Carminative, stimulant, diuretic, stomachic.

USES.—Flatulent colic, especially of infants, corrective to nauseous purgatives, flavoring, toothache (carvacrol), as a spice in cakes, bread, etc. The oil is used mostly, which acts externally like other essential oils, as an anesthetic, etc.

ANISUM. ANISE, *N.F.*

Oleum Anisi. Oil of Anise, *U.S.P.*

Pimpinella Anisum, *Linné,* or **Illicium verum,** *Hooker filius.* } The volatile oil distilled from the dried ripe fruits.

Habitat. W. Asia, Egypt, S. E. Europe; cultivated in S. Europe, United States, in gardens.

Syn. Anis., Aniseed, Aneys, Aunyle, Common Anise, Sweet Cumin, Semen Anisi; Br. Anisi Fructus; Fr. Anis, Anis vert, Graines d'Anise; Ger. Anis, Anissame; Ol. Anisi, Anise Oil; Fr. Essence d'Anis; Ger. Anisöl, Anethol.

Pim-pi-nel'la. L. Medieval name, altered, from *bipinnate* or *bipinnella*—*i. e.*, the pinnate leaves; lit. "the two-winged little plant."

An'i-sum. L. fr. Gr. ἄνισον—ἄνηθον, Ar, *anisum*, anise, dill—*i. e.*, classic name.

Il-li'ci-um. L. *illicere*, to allure, charm—*i. e.*, in allusion to its attractive perfume.

Ve'rum. L. *verus*, true—*i. e.*, the genuine or real type.

PLANTS.—*Pimpinella Anisum:* Annual herb .3 M. (1°) high; dentate, pinnatifid; flowers white, small, umbels 8–14-rayed. Fruit—Anisum, Anise (Seed), *N.F.*—The dried ripe fruit with not more than 3 p. c. of other fruits, seeds or foreign organic matter, yielding not more than 1.5 p. c. of acid-insoluble ash; cremocarp, broadly oval compressed, mericarps usually cohering and attached to slender pedicel 2–12 Mm. ($\frac{1}{12}$–$\frac{1}{2}$′) long, apex with 2 styles, grayish-green, seldom brownish, slightly pubescent; odor and taste agreeable, aromatic—Russian variety closely resembles conium. Powder, yellowish-brown—numerous fragments of pericarp with yellowish oil tubes, tracheæ, carpophore fibers, endosperm cells, aleurone grains, calcium oxalate rosette aggregates, non-glandular hairs. *Test:* 1. Heat 1 Gm. with potassium hydroxide T. S., (10)—no mouse-like odor (abs. of conium). *Illicium verum.*—Magnoliaceæ: Small tree, 3–6 M. (10–20° high, branched; leaves pellucid-punc-

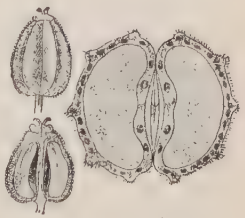


FIG. 289. — Anisum: fruit and longitudinal section magnified 3 diam.; transverse section magnified 8 diam.

tate; flowers greenish-yellow; Fruit, star-shaped—8 stellately arranged boat-shaped carpels, 8 Mm. ($\frac{1}{3}'$) long, brown, woody, wrinkled, each carpel containing 1 glossy-brown seed; solvents: alcohol, boiling water. Dose, gr. 10–30 (.6–2 Gm.).

CONSTITUENTS.—Volatile oil (anethol) 1–3 p. c., fixed oil 3–4 p. c., choline, resin, sugar, mucilage, malates, phosphates, ash 7 p. c.

Oleum Anisi. Oil of Anise. Oil of Star Anise, *U.S.P.*—This volatile oil is a colorless, pale yellow, strongly refractive liquid, characteristic odor and taste of anise, soluble with not more than slight cloudiness in 3 vols. of 90 p. c. alcohol; sp. gr. 0.983, increasing with age; contains a liquid body—terpenes and methyl-chavicol, $C_{10}H_{12}O$, and a stearoptene, anethol, $C_{10}H_{12}O$, 80–90 p. c., upon which the value depends, being converted by exposure or oxidation with nitric acid into anisic acid; star anise oil is the same chemically, containing anethol 80–90 p. c., *d*-pinene, *d*-phellandrene, and possibly safrol, but congeals at 1° C. (34° F.), while anise oil at 10–15° C. (50–59° F.). *Tests:* 1. Levorotatory (abs. of oils of fennel, caraway, coriander—dextrorotatory). 2. Shake with water in graduated tube—volume should not diminish; drop into water—no milkiness unless agitated (abs. of alcohol). 3. Alcoholic solution neutral; with a drop of ferric chloride T. S.—no blue or brown color (abs. of phenols). *Impurities:* Heavy metals, oil of fennel, phenols. The label must indicate definitely its specific source, and if solid material has separated, carefully warm the oil until liquefied and thoroughly mix before dispensing. Should be kept dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 cc.).

Anethol. Anethol, *N.F.*—The methyl ether of para-propenyl phenol $C_6H_4C_3H_5.OCH_3$, obtained from this and other oils (star anise, fennel), by fractionating, chilling, crystallizing; practically identical with the oil. It is a colorless, faintly yellow, highly refractive liquid at 23° C. (73° F.), sweet taste and aromatic odor of anise, solidifies at 20° C. (68° F.) to white glistening, crystalline mass, remelting at 22° C. (72° F.), soluble in ether, chloroform, alcohol (2), almost insoluble in water; sp. gr. 0.985, boils at 235° C. (455° F.); optically inactive, levorotatory (if from anise), dextrorotatory (if from fennel). *Test:* 1. Shake 10 cc. with 50 cc. saturated aqueous solution of sodium bisulphite in graduated cylinder, let stand 6 hours—no diminution of anethol volume nor crystalline deposit (abs. of aldehydes). Should be kept dark, in well-stoppered, amber-colored bottles. Dose, ♏ij–5 (.13–.3 cc.).

ADULTERATIONS.—FRUIT: Earthy fragments, partly exhausted fruits, recognized by shriveled appearance, chiefly, however, with conium fruit (which resembles mostly the Russian anise), but odor and taste not aromatic—becoming mouse-like with solution potassium hydroxide even when 1 p. c. present; non-hairy; consisting usually of single smooth mericarps, grooved upon the face, 5-crenate ribs (ridges) with wrinkles between them, no vittæ; POWDER: Star-anise recognized

by its peculiar sclerotic cells, earthy matter sinking when stirred in strong brine; OIL: Spermaceti 5–35 p. c., wax, petroleum, fixed oils, oils of turpentine and fennel, camphor (to raise congealing-point), alcohol, fenchone (fennel stearoptene); the two first insoluble in cold alcohol, whereas oils and camphor are mostly soluble; camphors recognized—by odor; alcohol—by milkiness to water; star-anise oil is the same chemically, but has a slight distinguishing smell and taste, also lower congealing-point (1° C.; 34° F.).

Commercial.—Plant was known and cultivated by the Romans, while Theophrastus wrote of its aromatic properties; now grown mostly in Malta, Spain, Italy, S. Russia, Greece, Chile. There are four varieties: 1, *Spanish* (*Alicante*), small, best, preferred; 2, *German* (*French*), larger; 3, *Italian*, exported via Leghorn; 4, *Russian*, very short, resembling conium most; that cultivated at home supplies largely our market.

PREPARATIONS.—OIL: 1. *Aqua Anisi.* Anise Water. (Syn., Aq. Anisi; Fr. Eau d'Anis; Ger. Aniswasser.)

Manufacture: $\frac{1}{5}$ p. c. A saturated solution; similar to Aquæ Aromaticæ—triturate oil .2 cc. with purified talc 1.5 Gm., adding gradually recently boiled distilled water q. s. 100 cc. Dose, ʒij–8 (8–30 cc.).

2. *Spiritus Anisi.* Spirit of Anise. (Syn., Sp. Anisi, Essentia Anisi; Fr. Alcoolat (Esprit) d'Anis; Ger. Anisgeist.)

Manufacture: 10 p. c. Mix oil 10 cc. with alcohol q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

3. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{4}$ p. c. 4. *Spiritus Aurantii Compositus,* $\frac{1}{2}$ p. c. 5. *Syrupus Sarsaparillæ Compositus,* $\frac{1}{50}$ p. c. 6. *Tinctura Opii Camphorata,* $\frac{2}{5}$ p. c. 7. *Elixir Phosphori, N.F.* $\frac{1}{5}$ p. c.; 8. *Syrupus Trifolii Compositus, N.F.,* $\frac{1}{50}$ p. c. 9. *Tinctura Opii et Gambir Composita, N.F.,* $\frac{1}{10}$ p. c. FRUIT: 1. *Species Laxativæ, N.F.,* 12.5 p. c. 2. *Species Pectorales, N.F.,* 10 p. c. 3. *Tinctura Rhei Dulcis, N.F.,* 4 p. c. ANETHOL: 1. *Elixir Anisi, N.F.,* .35 p. c. 2. *Pulvis Rhei et Magnesiæ Anisatus, N.F.,* 8 p. c. 3. *Spiritus Ammoniæ Anisatus, N.F.,* 3 p. c. 4. *Spiritus Cardamomi Compositus, N.F.,* $\frac{1}{2}$ p. c.

Unoff. Preps.: FRUIT: *Fluidextract,* ♏x–30 (.6–2 cc.). *Infusion,* 5 p. c., ʒj–8 (4–30 cc.).

PROPERTIES.—Aromatic stimulant and carminative, stomachic, once supposed a galactagogue, now doubted, although it does impart peculiar taste to secreting milk.

USES.—Flatulent colic, bronchitis, infantile catarrh. As a corrigent to griping cathartics, but here fennel is preferred; much used for flavoring food, confectionery, and in veterinary practice.

Allied Plants:

1. *Pimpinella Saxif'raga* and *S. mag'na;* dried rhizome and roots; light yellowish-brown, aromatic, sweetish, pungent; composition, properties and uses similar to anise. Dose, gr. 10–30 (.6–2 Gm.); tincture, 20 p. c. (67 p. c. alcohol).

FŒNICULUM. FENNEL, *N.F.*

Oleum Fœniculi. Oil of Fennel, *U.S.P.*

Fœniculum vulgare, *Miller.* { The volatile oil distilled from the dried ripe fruit.

Habitat. S. Europe, W. Asia; cultivated.

Syn. Fœnic., Fennel Seed (Fruit), Large, Giant, Sweet or Wild Fennel, Semen Fœniculi; Br. Fœniculi Fructus; Fr. Fenouil dulce, Fruits (Semences) de Fenouil; Ger. Fenchel (fructus, semen); Ol. Fœnic., Fennel Oil; Fr. Essence de Fenouil; Ger. Fenchelöl.

Fœ-nic'u-lum. L. fennel, dim. of *fenum* or *fœnum*, hay—*i. e.*, from a resemblance in odor.

Vul-ga're. L. *vulgaris*, common, ordinary—*i. e.*, kind growing wild, and in general use, originally not cultivated.

Plant.—Large, perennial (biennial, annual) herb; stem .6–1.2 M. (2–4°) high, furrowed, green, glaucous, branched; rootstock thick; leaves twice pinnate, pinnæ very narrow, often only as wide as the thin petiole; flowers yellow, 15–20 in umbels, all parts with agreeable aromatic odor; sweet, aromatic taste. Fruit—Fœniculum, Fennel (Seed), *N.F.* The dried, ripe fruit of cultivated varieties with not more than 4 p. c. of foreign organic matter; mericarps usually separate, broadly elliptical 4–15 Mm. ($\frac{1}{6}$–$\frac{3}{5}$′) long, 1–3.5 Mm. ($\frac{1}{25}$–$\frac{1}{7}$′) broad, commissural surface flattened, some with a slender stalk, 2–10 Mm. ($1\frac{1}{2}$–$\frac{2}{5}$′) long, dorsal surface convex, yellowish-green, 5 prominent ribs and short stylopodium at summit. Powder, yellowish-brown—endosperm cells with aleurone grains, calcium oxalate rosettes, oil tubes, few strongly lignified fibers, tracheæ few, fixed oil globules; solvents: alcohol (extracts virtues—volatile oil), hot water partially. Dose, gr. 10–30 (.6–2 Gm.).

Constituents.—Volatile oil 2–6 p. c., fixed oil 12 p. c., sugar, mucilage, ash 9 p. c.

Oleum Fœniculi. Oil of Fennel.—This volatile oil distilled with water or steam, from the dried ripe fruit of cultivated varieties, is a colorless, pale yellow liquid, characteristic odor and taste of fennel, soluble in 8 vols. of 80 p. c. alcohol, 1 vol. of 90 p. c. alcohol, forming neutral solution, sp. gr. 0.963, dextrorotatory, congeals at 3° C. (37° F.); contains (about the same as oil of anise) pinene, phellandrene ($C_{10}H_{16}$—substances isomeric with oil of turpentine), dipentene (sometimes limonene), fenchone (bitter camphor), $C_{10}H_{16}O$, anethol, $C_{10}H_{12}O$, 60 p. c., also its isomer chavicol, anise ketone, anisic aldehyde, and anisic acid. Anethol gives largely the value, crystallizes out in the cold, and consists of two portions (1) liquid—eleoptene, (2) solid—stearoptene, the percentage of the two not always being uniform, some specimens of oil having more of the solid, while others (best) more of the liquid anethol. The oil from different sources is usually

without some of these constituents (either phellandrene, fenchone, or anethol), thus limonene occurs in the Macedonian; pinene and dipentene in the Saxon; fenchone in the Saxon, Galician, Moravian, Roumanian and Japanese, but not in the Roman and Macedonian; phellandrene in the wild (bitter), which, as a rule, has no anethol. *Tests:* 1. With ferric chloride T. S.—not blue or dark (abs. of volatile oils

a *b*

FIG. 290.—*Fœniculum vulgare:* *a*, cross-section of fruit, *b*, flower with stamens.

containing phenol). 2. Dropped into water and not shaken—no milkiness (abs. of alcohol). Should be kept cool, dark, in well-stoppered amber-colored bottles, and if partly or wholly solidified must be completely liquefied by careful warming and thoroughly mixed before dispensing. Dose, ♏ij–5 (.13–.3 cc.).

ADULTERATIONS.—FRUIT: Exhausted fruit (yielding yellowish instead of dark brown infusion) often tinged with chrome-yellow (removed by rubbing with alcohol) and mixed with genuine, entire or ground; damaged wheat, oat, poppy and lentil seeds, stones, pieces of marble, colored yellow with iron-ochre, 16–66 p. c.; OIL: Alcohol, oil deprived more or less of anethol, oil of turpentine (lowering the congealing point), other volatile and fixed oils.

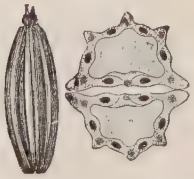


FIG. 291.—Fœniculum fruit: 3 diam.; transverse section, 8 diam.

Commercial.—Plant variation (in size, habit, shape and cutting of leaves, number of rays in umbels, and shape of fruits) is due to the cultivation for centuries of the wild *F. vulgare*, thereby producing several well-marked new species (?) that flourish in all except cold climates, and in turn revert to the original wild form. Fruit is obtained mostly under cultivation from Germany, France, and Russia, although we produce much of our own supply; the French, German, and Indian conform to the *N. F.* description, the Russian and Japanese being

only half the size, as is also the *wild (bitter)* grown in France; all sometimes sold as *longs* and *shorts*, the former having preference. Cultivated in Italy not only for fruit, but for stem and young shoots as a vegetable, while the root is used in medicine with less satisfaction. There are five varieties: 1, *French (Roman, Sweet)*, large straight, curved, sweetish, greenish-yellow, by some referred to *F. dulce* or *F. sativum*, but under cultivation it soon reverts to the original wild form, *F. vulgare;* 2, *German (Saxon—F. vulgare)*, large, greenish, by some preferred; 3, *Indian (F. panmo'rium);* 4, *Russian (Roumanian);* 5, *Japanese.*

PREPARATIONS.—OIL: 1. *Aqua Fœniculi.* Fennel Water. (Syn., Aq. Fœnic.; Fr. Eau de Fenouil; Ger. Fenchelwasser.)

Manufacture: $\frac{1}{5}$ p. c. A saturated solution; similar to Aquæ Aromaticæ—triturate oil .2 cc. with purified talc 1.5 Gm., adding gradually recently boiled distilled water q. s. 100 cc., filter until clear. Dose, ʒij–8 (8–30 cc.).

2. *Pulvis Glycyrrhizæ Compositus,* $\frac{2}{5}$ p. c. 3. *Elixir Anisi, N.F.,* $\frac{1}{20}$ p. c. 4. *Elixir Catariæ et Fœniculi, N.F.,* $\frac{1}{5}$ p. c. 5. *Fluidglyceratum Cascaræ Sagradæ Aromaticum, N.F.,* $\frac{1}{10}$ p. c. 6. *Mistura Carminativa, N.F.,* $\frac{1}{20}$ p. c. 7. *Syrupus Ficus Compositus, N.F.,* $\frac{1}{10}$ p. c. 8. *Syrupus Rhamni Catharticæ, N.F.,* $\frac{1}{50}$ p. c.; FRUIT: 1. *Infusum Sennæ Compositum, N.F.,* 2 p. c. 2. *Pilulæ Antiperiodicæ, N.F.,* $\frac{1}{4}$ gr. 3. *Species Laxativæ, N.F.,* 12.5 p. c. 4. *Tinctura Antiperiodica, N.F.,* $\frac{2}{5}$ p. c.

Unoff. Preps.: FRUIT: *Fluidextract,* ♏x–30 (.6–2 cc.); *Infusion,* 5 p. c., ʒj–16 (4–60 cc.); *Syrup* (fruit or oil).

PROPERTIES.—Carminative, stimulant, diaphoretic, aromatic, stomachic, galactagogue; employed by the ancients very similarly.

USES.—Nausea, colic, amenorrhea, infantile flatulency; increases the secretion of milk, perspiration, mucus, urine; as a corrective to griping medicines, senna, rhubarb, etc. Much used in cattle medicines, the oil in cordials, elixirs.

Allied Plants:

1. *Angel'ica Archangel'ica, European Angelica;* 1. *Angelica Radix, Angelica Root, N.F.*—The dried rhizome and roots of this and other species with not more than 5 p. c. of stem-bases or other foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; 2. *Angelica Fructus, Angelica Fruit (Seed), N.F.*—The dried ripe fruit of this and other species with not more than 3 p. c. of foreign fruits, seeds or other foreign organic matter; N. Europe, cultivated in Germany. Stout perennial herb, 1.8–2 M. (5–6°) high, purplish, smooth, hollow, jointed, leaves double pinnate; flowers greenish-white. Rhizome, short, thick, 5–10 Cm. (2–4′) long, sometimes split, frequently crowned with leaf and stem-bases; roots numerous 10–20 Cm. (4–8′) long, 5–7 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) thick at base, tapering to 1 Mm. ($\frac{1}{25}$′), twisted together, dark brown, deep furrows; fracture short, smooth; odor aromatic, taste sweetish, pungent, aromatic, bitter. Powder, yellowish-brown—starch grains, tracheæ, brownish oil canals, parenchyma tissue

with starch, cork cells, wood-fibers, yellowish oil globules. Fruit, cremocarps oval, yellowish-brown 4–8 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) long, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) broad, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, base notched, apex bearing 5 calyx teeth; mericarps joined or separate, each flat on one surface, convex upon the other, with 3 ribs, separated by grooves; odor characteristic, agreeable; taste aromatic, pungent, sweetish. Powder, light brown—spongy parenchyma, oil tubes, aleurone grains, calcium oxalate rosettes; solvent: alcohol; contain volatile oil .5 p. c., acrid resin (angelicin), angelic acid, tannin, pectin. Tonic, stimulant, carminative, diaphoretic, emetic; typhoid condition, bronchitis, intermittents; rheumatism, gout, painful swollen parts, condiment, Dose, gr. 10–30 (.6–2 Gm.); Root: 1. *Fluidextractum Angelicæ Radicis* (92 p. c. alcohol), dose, ♏xv–30 (1–2 cc.); Infusion, Tincture, Fresh juice (poisonous); Fruit: 1. *Pilulæ Antiperiodicæ*, ½ gr. (.03 Gm.); 2. *Tinctura Antiperiodica*, $\frac{4}{5}$ p. c.

Fig. 292.—Angelica—flowering stem and cross-section of cremocarp: *a*, the seed; *f*, the 2-ribbed wings (mericarps).

3. *Ane'thum* (*Peuced'anum*) *grave'olens*, *Anethi Fructus*, *Dill Fruit* (Br.).—S. Europe, Asia. Herb .6 M. (2°) high; leaves finely divided, glaucous; flowers yellow; fruit oblong, 4 Mm. ($\frac{1}{6}$′) long, brown, smooth, mericarps 2, flat-faced, each having 5 ribs, 6 vittæ, of which 3 are filiform, 2 lateral ones broadly winged, light colored, odor, and taste spicy, caraway-like; contains volatile oil 3–4 p. c., fixed oil Carminative, stimulant, stomachic, condiment, flavoring; as a substitute for anise and caraway in flatulent colic, hiccough, indigestion. Dose, gr. 10–30 (.6–2 Gm.); volatile oil (*Oleum Anethi*, Br.), ♏ij–5 (.13–.3 cc.); *Aqua Anethi* (Br.), 10 p. c., ℥ss–2 (15–60 cc.).

4. *Opop'anax Opopanax* (*Chiro'nium*).—S. Europe. Root and stem exude yellowish milk, hardening into reddish-brown tears, having a waxy luster, and a bitter, balsamic taste.

ASAFŒTIDA. ASAFETIDA, *U.S.P.*

Ferula { **Asafœtida,** *Linné,* **fœtida,** *Regal,* and other species. } The gum-resin obtained by incising the living rhizomes and roots, yielding not less than 50 p. c. alcohol-soluble extractive, and not more than 15 p. c. acid-insoluble ash.

Habitat. Persia, Turkestan, Afghanistan; mountain slopes, barren desolate wastes, sandy deserts.

Syn. Asafœt., Gum Asafetida, Devil's Dung (Stercus Diaboli), Food of the Gods (Cibus Deorum), Gummi-resina Asafœtida; Fr. Asa Fœtida; Ger. Asa fœtida, Asant, Stinkasant, Teufelsdreck.

Fer'u-la. L. fr. *ferio, ferire,* to strike—*i. e.,* stems used as rods, with which, at one time, schoolboys were punished.

Fœt'i-da. L. *fœtidus,* fetid, stinking—*i. e.,* the odor of the plant, and its secretion.

As'a-fœt'i-da. L. fr. Pers. *aza, asa,* mastic, + L. *fœtida,* fetid, stinking—stinking mastic—*i. e.,* its odor, resemblance, and consistency.

PLANTS.—Large perennial herbs; stems 1.5–3 M. (5–10°) high, 2.5–7.5 Cm. (1–3′) thick, greenish, erect, furrowed, smooth; leaves few, radical and cauline, mostly near stem's base, .3–.6 M. (1–2°) long and broad, on stout round petioles, 22.5 Cm. (9′) long, expanding below into inflated sheath surrounding one-half the stem, imparipinnate, ternately divided, each bipinnate with few pinnæ, leaflets few; flowers small, monœcious, yellow; roots conical, 45 Cm. (18′) long, 10–15 Cm. (4–6′) thick, branched, dark brown, internally whitish. GUM-RESIN (asafetida), in soft mass, semi-liquid, irregular pliable masses composed of agglutinated tears of variable size imbedded in yellowish-brown matrix, or in loose ovoid tears, 1–4 Cm. ($\frac{2}{5}$–$1\frac{3}{5}$′) broad, surface often with streaks of violet, yellowish-red, brownish, few vegetable fragments; soft or tough (fresh), hard even brittle (dry); fresh fractured surface of tears milky-white and opaque, changing gradually on exposure to pinkish, reddish-purple; tears moistened with water—milky-white; odor persistent, alliaceous; taste bitter, alliaceous, acrid. POWDER, light brown. *Tests:* 1. Triturate with water (3)—milk-white emulsion, yellowish with alkalies. 2. Heat tear with sulphuric acid—reddish-brown solution, which diluted with water, filtered, + excess of alkali—blue fluorescent solution, more pronounced with excess of ammonia water. 3. Alcohol filtrate (from assay) 10 cc., + few drops of phloroglucinol T. S. + few drops of hydrochloric acid—cherry-red. 4. Incinerate—ash 15 (gum-resin)–30 (powder) p. c. 5. Alcoholic filtrate 5 cc., + a few drop of ferric chloride T. S.—olive green (abs. of most foreign resins); alcoholic filtrate 10 cc., + hydrochloric acid until faint turbidity—bluish-green, fading on standing (abs. of galbanum). 6. Emulsion 2 cc. + water 5, + sodium hypobromite T. S. (5) to form separate layer—no red color (abs. of ammoniac). *Impurities:* Foreign resins, ammoniac, galbanum, rosin, etc. *Solvent:* alcohol. Dose, gr. 3–10 (.2–.6 Gm.).

Adulterations.—Divisible into 4 groups: 1, plant's tissues (insoluble in alcohol); 2, local associated gums; 3, earthy substances (ash, alcohol-insoluble residue); 4, turpentine products. Although some of these are added after reaching Europe, most of the adulterating occurs in its native country at Herat, before being conveyed to Bombay, where are used red clay (tawah), sand, stones, wheat or barley flour, gypsum, calcium carbonate, calcium sulphate, cloth, bristles, wood, rosin, resins, translucent gums—all amounting sometimes to 60–80 p. c., and yielding an ash of 15–20–40 p. c.; at present rigorously inspected with us so as to comply with official requirements.

Fig. 293.—*Ferula fœtida.*

Commercial.—Asafetida has been known in the East from early times and much studied since 1687; plants endure many years, producing each spring simply a crop of radical leaves but finally a scape with flowers and then die; the oldest are most productive, none being cut until the 5th year. In April, when leaves begin to wither, collection is started by pulling off the leafy stem, laying bare the upper portion of root-stock, 5–7.5 Cm. (2–3′) deep, and cutting a slice from the top, whereupon milky juice exudes but is not collected; the fresh exposed surface is protected from the sun's heat by a covering (*khora*), a crude domed structure several inches high of herbage and twigs, surmounted by clay and stones, save an opening on the north. On returning in about 40 days (May) the cut surface is found covered with a thick, gummy, reddish substance, not milky but in more or

less irregular lumps resembling ordinary asafetida, which is scraped off into cups or leather (kid, goat) bags, and a thin slice of the root removed for fresh exudation—a process repeated at 10-day intervals until the root perishes or is exhausted (2 months); each subsequent cutting yields a thicker, better juice provided the root be screened properly all the time from the sun. The product from many plants is mixed, further hardened in the sun and forwarded to Herat, whence it enters commerce via Bombay, in skins, mats (80–90 pounds; 36–40.5 Kg.), boxes (200–400 pounds; 91–182 Kg.), and casks. Each root yields ½–32 ounces (.015–1 Kg.); the purest, called natively *hing* (usually soft, transparent, and considered a stem product) is consumed in India, while the mixed, called *hingra*, alone is exported. It may be powdered when excessively cold, or by drying over freshly burnt lime or exposure to currents of warm air, then reducing at low temperature; starch or magnesium carbonate as a diluent will maintain powdered form. There are four varieties: 1, *Amygdaloid (Lump)*, official kind, considered most reliable; 2, *Tears*, inferior, consisting of various-sized tears (pea, walnut), yellowish, roundish, flattened, oval, irregular-shaped, distinct or adhesive and agglutinated; 3, *Stony*, various-sized, angular or rounded pieces of gypsum and other earthy matters agglutinated or merely coated with the milky juice, and should not be used in medicine; 4, *Liquid*, white, opaque, syrupy, or semi-fluid mass turning brown with age, possibly the first exudate or due to moist season.

Constituents.—Gum 20–30 p. c., Resin 60–70 p. c., Volatile oil 6–9 p. c., vanillin .06 p. c., free ferulic (ferulaic) acid 1.3 p. c., free asaresino-tannol 1 p. c., formic, acetic, valeric and malic acids, ash (pure) 3–4 p. c.

Gum.—Partly soluble in water, the residue (bassorin) dissolves in alkalies, being reprecipitated by acids.

Resin.—Reddish-brown, amorphous, soluble in ether except 3–4 p. c. It is the ferulic acid ester of asaresino-tannol, and contains ferulic acid, $C_{10}H_{10}O_4$, and resino-tannol, $C_{24}H_{35}O_5$; upon dry distillation yields umbelliferon, $C_9H_6O_3$, and blue-colored oils; when fused with potassium hydroxide gives resorcin and protocatechuic acid.

Volatile Oil.—This, to which the odor and stimulating property are due, is obtained by distilling with water or alcohol; sp. gr. 0.980; it is a mixture of several sulphides of feruly1, ($C_7H_{14}S_2$ and $C_{11}H_{20}S_2$), two terpenes, ($C_{10}H_{16}$ and $C_{10}H_{16}O$), the latter yielding a sesquiterpene, $C_{15}H_{24}$, and a blue-colored oil in the higher boiling portions.

Preparations.—1. *Emulsum Asafœtidæ.* Emulsion of Asafetida. (Syn., Emuls. Asafœt., Milk of Asafetida, Mistura (Lac) Asafœtidæ; Fr. Mixture (Lait) d'Asafœtida; Ger. Asafœtidaemulsion, Stinkasantmilch.)

Manufacture: 4 p. c. Rub asafetida (tears, selected masses) 4 Gm. in a mortar with water 90 cc., gradually added until uniform emulsion results, strain, rinse mortar and strainer with water q. s. 100 cc., mix thoroughly. Dose, ℥ss–1 (15–30 cc.).

2. *Pilulæ Asafœtidæ.* Pills of Asafetida. (Syn., Pil. Asafœt.; Fr. Pilules d'Asafétide; Ger. Asafœtidapillen.)

Manufacture: Incorporate intimately asafetida 20 Gm., soap 6 Gm., using water q. s. 100 pills. Dose, 2–5 pills.

3. *Tinctura Asafœtidæ.* Tincture of Asafetida. (Syn., Tr. Asafœt.; Fr. Teinture d'Asefétide; Ger. Tinctura Asæ-fœtidæ, Stinkasanttinktur.)

Manufacture: 20 p. c. Similar to Tinctura Cardamomi Composita, page 137; menstruum: alcohol. Dose, ʒss–1 (2–4 cc.).

Prep.: 1. *Mistura Magnesiæ, Asafœtidæ et Opii,* Dewees' Carminative, *N.F.,* 7.5 p.c. Dose, ʒss–4 (2–15 cc.).

4. *Pilulæ Aloes et Asafœtidæ, N.F.,* 1.5 gr. (.09 Gm.).

Unoff. Preps.: Asafœtida Præparata—exhaust with alcohol, thereby eliminating gum, evaporate or pour solution into slightly acidulated water, getting resin and volatile oil. *Fetid Spirit of Ammonia* (Br.), asafetida 7.5 p. c., stronger ammonia water 10, alcohol q. s. 100. *Compound Galbanum Pill. Enema* (1 in 64 water). *Plaster. Suppositories.*

Properties.—Similar to other drugs with volatile oils; stimulant, antispasmodic, expectorant, laxative, (emmenagogue, anthelmintic, condiment).

Uses.—Hysteria, hypochondriasis, convulsions, spasms, whooping-cough, measles, asthma, coughs, catarrhs, flatulent constipation, chorea, nervous apoplexy, consumption. Used in India, Persia, etc., as a condiment, for flavoring food, etc., like garlic and onions; acts here as a stimulant to the bowels and digestion. The natives value it highly, not only for its agreeable effect, but also for the odor and taste; a tolerance of this latter in most cases is acquired gradually by usage, as at first it is often nauseous and positively disgusting.

Incompatibles: Cerebral and arterial depressants, cold, acids, neutral salts; water with alcoholic liquid preparations.

Synergists: Cerebral excitants, alcohol, ether, gum-resins, balsams, aromatics, volatile oils containing sulphur and phosphorus. *F. Narthex* (*Narthex Asafœtida*), U.S.P. 1820–1870, is a plant almost identical with *F. fœtida.* and from it much gum-resin is collected and sent in with the official, as it is nearly impossible to recognize plant origin by the product.

Allied Plants:

1. *Ferula Sum'bul, Sumbul, Musk-root, N.F.*—The dried rhizome and roots of this, or other closely related species possessing a characteristic musk-like odor, with not more than 2 p. c. of foreign organic matter; C. and N. W. Asia, Turkestan, Russia—mountains. Perennial herb, dying after flowering, 2–3 M. (6–10°) high, 4 Cm. ($1\frac{3}{5}'$) thick at base, solid, purplish, exuding milk juice when injured; leaves radical and cauline, tripinnate; leaflets ovate, dentate, bright green; flowers polygamous; fruit 12 Mm. ($\frac{1}{2}'$) long, 6 Mm. ($\frac{1}{4}'$) broad, mericarps with 3 dorsal ridges, no dorsal vittæ. Rhizome, fusiform, vertical, in transverse segments, 2.5–10 Cm. (1–4′) long, 2.5–7 Cm. (1–$2\frac{4}{5}'$) thick,

extremely light in weight, light brown, wrinkled, heavily annulate; fracture short, fibrous, spongy, yellowish, brownish resinous patches; odor peculiar, musk-like; taste bitter, aromatic. Powder, grayish-brown—tracheæ, few epidermal cells, sieve tissue, occasional parenchyma fragments, few starch grains; solvent: alcohol (67–80 p. c.); contains volatile oil (bluish, peppermint taste) .33–1 p. c., resin (soft, musk odor) 9 p. c., fixed oil 17 p. c., angelic (sumbulic) acid, valeric acid, bitter extractive, sugar, starch, ash 5–6 p. c. Stimulant, carminative, tonic, nervine (resembles musk and valerian), antispasmodic; hysteria, female nervousness, epilepsy, chlorosis, amenorrhea, hypochondriasis, often combined with asafetida in nervous troubles, with iron and arsenic in chlorosis. Dose, gr. 10–30 (.6–2 Gm.); 1. *Extractum Sumbul* (80 p. c. alcohol—yield 15 p. c.), dose, gr. 2–5 (.13–.3 Gm.); 2. *Tinctura Sumbul*, 10 p. c. (67 p. c. alcohol), dose, ʒss–2 (2–8 cc.). Fluidextract. Resin.

Fig. 294.—Sumbul root: section.

2. *F. galbanif'lua, Galbanum.*—The gum-resin, U.S.P. 1820–1880; N. Persia. Plant 1.3–1.6 M. (4–5°) high, 2.5 Cm. (1′) thick, solid, striate, leaves radical and cauline; flowers yellow; fruit 12 Mm. ($\frac{1}{2}$′) long, winged near face of mericarps. Gum-resin in tears size of pin-head to that of a pea, brownish-yellow, inside milk-white, waxy, odor peculiar, balsamic, taste bitter, acrid, with water gives milky emulsion. Obtained from incisions; contains gum 15–20 p. c., resin 60–66 p. c., volatile oil 10–20 p. c., free umbelliferon .25 p. c., umbelliferon combined with galbano-resino-tannol 20 p. c., ash 8–10 p. c. Stimulant, expectorant, antispasmodic; hysteria, chlorosis, catarrh, amenorrhea, rheumatism, bronchitis, for church incense, tumors, boils, in pill (Pilula Galbani Composita), emulsion, plasters, tincture. Dose, gr. 5–20 (.3–1.3 Gm.). It is intermediate between asafetida and ammoniac.

3. *Dore'ma Ammoni'acum, Ammoniacum, Ammoniac.*—The gum-resin, U.S.P. 1820–1890; E. Persia, Turkestan. Plant of striking appearance, dying after flowering; stem 1.6–2 M. (5–7°) high, greenish, joints greenish-purple; flowers small, white; leaves—radical and cauline. Gum-resin (ammoniac) exudes from stem and root, through fissures (due to varying temperature) or animal and insect punctures. It is in *tears* or *cakes*, the former preferred when 1.5–6 Mm. ($\frac{1}{16}$–$\frac{1}{4}$′) thick, yellowish, fracture conchoidal, waxy, milk-white; odor peculiar; taste acrid, bitter, nauseous; contains gum 18–28 p. c., resin 70 p. c., volatile oil 1–4 p. c., ash 1–4 p. c. Stimulant, expectorant, rubefacient, similar to but less powerful than asafetida; bronchitis, chronic catarrh, asthma, pleurisy; externally resolvent in white swelling, tumors, glandular enlargements. Dose, gr. 10–30 (.6–2 Gm.); emulsion (water—milky), 4 p. c., ʒss–1 (15–30 cc.). The root, under the name

of Bombay Sumbul or Boi, although of closer texture, firmer, denser, and more reddish is used largely to adulterate the "false sumbul" so prevalent with us in the past, but it in reality resembles more closely our present *Ferula Sumbul* root of the *N.F.* *D. Au'cheri*, W. Persia, yields also a similar product (ammoniac), while *D. robus'tum* gives a dissimilar gum-resin. *Ferula tingita'na, African Ammoniac*, is believed

FIG. 295.—*Ferula galbaniflua.*

to be the "Ammoniacum" of the ancients; it is darker than our ammoniac, with agreeable odor like benzoin, but bitter, acrid taste; contains gum 9 p. c., resin 68 p. c., and yields umbelliferon.

4. *Heracle'um lana'tum, Cow-parsnip, Masterwort.*—The root, U.S.P. 1820–1850; United States. Plant 1.5–3 M. (5–10°) high, 2.5–4 Cm. (1–1$\frac{3}{5}$′) thick, pubescent, hollow; root resembles parsley, disagreeable

odor, acrid taste, fruit has each mericarp with 5 ribs and 6 vittæ; contains volatile oil, resin. Stimulant, carminative; epilepsy, dyspepsia, warts, escharotic; in infusion, juice. Dose, 5ss–1 (2–4 Gm.).

5. *Dau'cus Caro'ta, Carrot (Seed).*—The fruit, U.S.P. 1820–1870; N. Asia, Europe; biennial herb, .6–1 M. (2–3°) high, hispid; flowers July–Sept., white; root fleshy, fusiform, aromatic, edible; fruit 4 Mm. ($\frac{1}{6}'$) long, oval, flat, grayish-brown, each mericarp with 9 ribs, 6 vittæ; odor aromatic; taste pungent; contains volatile oil, fixed oil. Stimulant, diuretic, excitant; dropsy, strangury, nephritic affections, amenorrhea, ulcers, eczema, itching; in infusion, fluidextract. Dose, gr. 10–30 (.6–2 Gm.).

FIG. 296.—*Dorema Ammoniacum.*

6. *Cor'nus flor'ida, Cornus, Dogwood Bark, N.F.*, Cornaceæ.—The dried root-bark with not more than 5 p. c. of adhering wood nor 2 p. c. of other foreign organic matter; N. America. Small tree, 4.5–10.5 M. (15–35°) high, 12.5–25 Cm. (5–10′) thick, flowers greenish with 4 large white involucral leaves, petaloid; fruit bright red. Bark, in irregular, chip-like pieces, portions of quills less than 5 Cm. (2′) long, bark 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}'$) thick, scaly, dingy brown, reddish where corky layers removed, heavy cork patches wanting (abs. of trunk bark); inner surface reddish-brown, short striæ; fracture short, roughened from stone cells; odor slight; taste bitter, astringent. Powder, reddish-

FIG. 297.—*Daucus Carota:* magnified 5 diam.

brown—parenchyma cells with amorphous substance, stone cells, numerous calcium oxalate rosette crystals, starch grains, cork with brownish pigment; lignified fibers and tracheæ very few or wanting (abs. of trunk bark and wood); solvent: diluted alcohol; contains

cornin (cornic acid), tannin 3 p. c., resin, ash 10 p. c. Astringent, tonic, febrifuge, stimulant; when fresh—emetic; formerly in large doses as an antiperiodic, given between the paroxysms, instead of cinchona, but owing to inferiority now seldom employed. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Corni* (glycerin 15, diluted alcohol 85). Decoction, 5 p. c., ℥j–2 (30–60 cc.).

7. *C. circina'ta, Round-leaved Dogwood.*—The bark, U.S.P. 1820–1860; N. America. Shrub 1.6–3 M. (5–10°) high, branches greenish, warty; leaves round, 10–12.5 Cm. (4–5′) wide, woolly beneath; flowers white cymes; fruit, blue drupe. Bark quilled, curved, greenish, brownish-gray, with suberous warts or longitudinal lines, inside cinnamon-brown; used like *C. florida,* but is more bitter and less astringent.

Fig. 298.—*Cornus florida.*

8. *C. Amo'mum* (*seric'ea*), *Silky Cornel, Swamp Dogwood.*—The bark, U.S.P. 1820–1870; N. America. Shrub 1.6–3 M. (5–10°) high, branches purple; leaves elliptical, silky beneath; flowers yellowish, woolly cymes; fruit pale blue. Bark quilled, thin, outside purplish-brown, less warty than preceding, otherwise resembles it; used like *C. florida,* but is less bitter and astringent.

RECAPITULATION TABLE NO. 4—U.S. P. DRUGS AND PREPARATIONS.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Dose.
Rutaceæ:								
1. Pilocarpinæ Hydrochloridum.	Pilocarpus: Jaborandi, microphyllus.	The alkaloidal salts from the leaves.	S. America (Brazil).	$C_{11}H_{16}O_2N_2.HCl$.	.....	Diaphoretic, sialagogue, myotic, emetic, cardiac depressant.	Dropsy, rheumatism, pleurisy, coryza, Bright's disease, eye affections.	Grains. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.).
2. Pilocarpine Hydrochloride.				$C_{11}H_{16}O_2N_2.HNO_3$.				
1. Pilocarpinæ Nitras.								
2. Pilocarpine Nitrate.								
1. Aurantii Amari Cortex.	Citrus Aurantium (var. amara).	The dried rind of unripe fruit. Vol. oil of flowers.	N. India.	Volatile oil (naringin, aurantiamarin), hesperidin, tannin, resin. *Oil:* limonene, geraniol, anthranilate.	Tinct., tr. cinch. co., tr. gent. co. (*Ol. aur. flo.*): aqua, syr. Syr., tinct., *Oil:* sp. comp., elix. aro.	Stimulant, tonic, carminative, stomachic, flavor.	Indigestion, flatulence, corrigent to purgatives.	15–30 (1–2 Gm.). oil: ♏j–5 (.06–.3 cc.).
2. Bitter Orange Peel.								
1. Aurantii Dulcis Cortex.	Citrus Aurantium, var. sinensis.	The fresh outer rind of ripe fruit.						
2. Sweet Orange Peel.								
1. Limonis Cortex.	Citrus medica, var. Limonum.	The outer yellow rind of fresh ripe fruit.	N. India.	Volatile oil, bitter principle, hesperidin.	Tinct., *Oil:* spiritus aurantii comp., spt. ammon. ar., liq. mag. cit.	Stimulant, stomachic, flavor.	Indigestion.	Grains. 30–60 (2–4 Gm.).
2. Lemon Peel.								
Simarubaceæ:								
1. Quassia.	Picrasma excelsa, Quassia amara.	The wood.	W. Indies, Surinam.	Picrasmin (quassiin), resin, alkaloid, mucilage.	.....	Tonic, febrifuge, anthelmintic, bitter.	Dyspepsia, diarrhea, constipation, loss of appetite.	15–60 (1–4 Gm.).
2. Quassia.								
Burseraceæ:								
1. Myrrha.	Commiphora Myrrha, or other species.	The gum-resin.	E. Africa.	Volatile oil, resin, gum, bitter principle.	Tincture.	Stimulant, tonic, expectorant, emmenagogue, vulnerary.	Dyspepsia, amenorrhea, anemia, pharyngitis, diseased gums, ulcers, disinfectant.	5–30 (.3–2 Gm.).
2. Myrrh.								
Polygalaceæ:								
1. Senega.	Polygala Senega.	The dried root.	United States.	Senegin, polygalic acid, fixed oil, vol. oil, resin, pectin, malates.	Fluidextract, syrup, syrup squill comp.	Expectorant, diuretic diaphoretic.	Bronchitis, croup, asthma, renal dropsy, rheumatism, pneumonia, amenorrhea.	5–30 (.3–2 Gm.).
2. Senega.								
Euphorbiaceæ:								
1. Oleum Tiglii.	Croton Tiglium.	The fixed oil expressed from seeds.	India, Philippine Islands.	Glycerides of stearic, palmitic, myristic, lauric, oleic, formic, acetic, tiglinic, valeric acids, crotonol, croton-resin, crotonolic acid.	.....	Powerful purgative, irritant, rubefacient.	Mania, constipation, tenia, dropsies, dysentery, paralysis, rheumatism, swellings, pneumonia, ovaritis, pleurisy.	Minims. $\frac{1}{2}$–2 (.02–.13 cc.).
2. Croton Oil.								
1. Oleum Ricini.	Ricinus communis.	The fixed oil from seeds.	India, Europe.	Triricinolein, palmitin, ricinoleic acid.	.....	Purgative, demulcent.	Constipation, colic, diarrhea, enteritis, worms, fevers, calculi, amenorrhea, cystitis, gonorrhea.	60–480 (4–30 cc.).
2. Castor Oil.								

Anacardiaceæ:								Grains.
1. Rhus Glabra.	Rhus glabra.	The dried ripe fruit.	N. America.	Acid Ca, and K, malates, tannin, fixed oil.	Fluidextract.	Astringent, refrigerant, diuretic.	Stomach catarrh, tonsillitis, spongy gums, aphthe, ulcers, wounds.	30–60 (2–4 Gm.).
2. Rhus Glabra.								
Rhamnaceæ:								
1. Cascara Sagrada.	Rhamnus Purshiana.	The dried bark.	Western U. States.	Emodin, isoemodin, resin, tannin, vol. oil, rhamnol, ferment.	Fluidextract, extract, aro. fluidext.	Purgative, tonic, febrifuge.	Constipation, dyspepsia, hemorrhoids.	15–60 (1–4 Gm.).
2. Cascara Sagrada.								
Malvaceæ:								
1. Althæa.	Althæa officinalis.	The dried root.	Europe, W., N. Asia, United States.	Asparagin, mucilage, starch, pectin.	Mas. hydrarg., pil. ferri carb., pil. phosphori.	Demulcent, emollient, protective.	Inflammations: pulmonary, digestive, urinary tracts, skin eruptions, absorbent.	30–60 (2-4 Gm.).
2. Althea.								
1. Gossypium Purificatum.	.....	The hairs of the seed.	C. Asia, Africa, S. America.	Cellulose, fixed oil, inorganics.	Pyroxylin, collodion, flex. collodion.	Protective.	Dressing to burns, surgical wounds, etc.	
2. Purified Cotton.	Gossypium herbaceum, +.							
1. Oleum Gossypii Seminis.	.....	The refined fixed oil.		Olein, palmitin, linolein, linoleic acid.	Soft soap, lins. s. soap, camph.	Demulcent, nutrient.	For olive, almond oil, liniments.	Minims. 120–480 (8–30 cc.).
2. Cottonseed Oil.								
Sterculiaceæ:								Grains.
1. Oleum Theobromatis.	Theobroma Cacao.	The fat from roasted seeds.	S. America.	Stearin, palmitin, laurin, glycerides: formic acetic, butyric, linoleic acids.	.....	Demulcent, emollient, nutrient.	Abraded surfaces, base for suppositories, ointments.	30–60 (2–4 Gm.).
2. Oil of Theobroma.								
Theaceæ, see Rubiaceæ.	Thea sinensis.							
Guttiferæ:								
1. Cambogia.	Garcinia Hanburyi.	The gum resin.	Camboja, Annam, Siam.	Gum, resin, (cambogic acid), vol. oil.	Pil. hydrarg. chlor. mit. co.	Drastic, hydragogue cathartic.	Liver and kidney diseases, vermifuge, dropsy.	½–5 (.03–.3 Gm.).
2. Gamboge.								
Flacourtiaceæ:								Minims.
1. Oleum Chaulmoogra.	Taraktogenos Kurzii, +.	The fixed oil.	S. Asia, India, Siam.	Chaulmoogric and hydnocarpic acids, palmitin, linolein.	Ethyl Chaulmoograte.	Alterative, germicide, antiseptic, blood-purifier.	Leprosy, sores, wounds, sprains, bruises.	5–30 (.3–2 cc.).
2. Chaulmoogra Oil.								
Lythraceæ:								Grains.
1. Granatum.	Punica Granatum.	The dried bark of stem and root.	S. W. Asia, India.	Punico-tannic acid, pelletierine, mannite, gum, pectin.	Fluidextract, pelletierine tannate.	Anthelmintic, tenifuge, astringent.	Tape- and lumbricoid worms.	30–120 (2–8 Gm.).
2. Pomegranate.								
Myrtaceæ:								
1. Caryophyllus.	Caryophyllus aromaticus.	The dried flower-buds.	Molucca (Clove) Islands.	Volatile oil, tannin, gum, resin, caryophyllin, vanillin, eugenol.	Tinct. lavend. comp., tinct. rhei ar., Oil, eugenol.	Stimulant, stomachic, antispasmodic, rubefacient.	Nausea, colic, condiment, rheumatism, neuralgia, toothache.	5–10 (.3–.6 Gm.).
2. Clove.								
1. Oleum Cajuputi.	Melaleuca Leucadendron.	The volatile oil.	E. India Islands.	Cineol, terpineol, *l*-pinene, valer., benz. aldehydes.	.....	Carminative, stimulant, diaphoretic, rubefacient.	Rheumatism, stomach, bowel troubles, colic, toothache, bronchitis, dysmenorrhea.	Minims. 2–10 (.13–.6 cc.).
2. Oil of Cajuput.								

ERICACEÆ

SERIES 2: **GAMOPETALÆ. Petals more or less united, rarely separate or wanting.**

52. ERICACEÆ. Heath Family.

Er-i-ka'se-e. L. *Eric-a* + aceæ, Gr. ἐρείκη, heath, fr. ἐρείκω, to break—*i. e.*, because some species break or dissolve stone in the bladder. Shrubs, small trees. Distinguished by astringent properties; leaves evergreen, exstipulate; calyx 4–5-cleft, inferior, corolla regular, hypogynous, 4–5-cleft; stamens as many or twice corolla-lobes, free from but inserted with corolla; anthers 2-celled; ovary 2–5-celled, style 1; fruit, capsule, or berry, edible; universal; astringent, tonic, diuretic, narcotic, poisonous.

Genera: **1. Gaultheria. 2. Arctostaphylos.**

GAULTHERIA. GAULTHERIA.

Methylis Salicylas. Methyl Salicylate, *U.S.P.*

Gaultheria procumbens, *Linné*, or **Betula lenta,** *Linné.* — An ester (compound ether) obtained by distilling leaves of the former, or bark of the latter, and produced synthetically.

Habitat. N. America, Newfoundland to Georgia, Minnesota; cold damp woods (shade of evergreens); forests.

Syn. Wintergreen, Spring (Creeping, Spicy, Aromatic) Wintergreen, Checker (Partridge) berry, Tea (Spice) berry, Mountain Tea; Black (Cherry, Mahogany, Sweet, Spice) Birch, Mountain Mahogany; Methyl, Salicyl., Oleum Gaultheriæ, U.S.P. 1900, Oil of Wintergreen; Oleum Betulæ, U.S.P. 1900, Oil of Sweet Birch, Oil of Teaberry; Fr. Salicylate de Méthyle; Ger. Künstliches Wintergrünöl.

Gaul-the'ri-a. L. dedicated by Kalm to Dr. Gaulther, of Quebec.

Pro-cum'bens. L. *pro*, forward, + *cumbere*, to lie, lying down—*i. e.*, the reclining habit of the stem.

Bet'u-la. L. fr. Celtic *betu*, the birch—*i. e.*, its original name.

Len'ta. L. *lentus*, soft, pliant, flexible—*i. e.*, its stems and branches.

PLANTS.—*Gaultheria procumbens*, stems slender, creeping on or below the surface, branches ascending, leafy at summit, 5–15 Cm. (2–6′) high; leaves obovate, alternate, evergreen, spicy, mucronate, serrate; flowers, June–Sept., few, white, nodding, mostly single in the axils; fruit (formed of calyx) bright red berries (capsules), 5-celled, spicy, aromatic; *Betula lenta*—Betulaceæ, tree 12–24 M. (40–80°) high, .6–1 M. (2–3°) thick; bark dark brown, close, smooth, sweet, aromatic; leaves 7.5–10 Cm. (3–4′) long, 2.5–5 Cm. (1–2′) broad, ovate, acuminate, serrate, petiolate; flowers, staminate (catkins) and pistillate; bark not separable into layers, cambium when wounded in the spring, exudes sweet, acid, edible juice; wood reddish, strong, compact.

CONSTITUENTS.—Methyl Salicylate (Volatile oil), resin, tannin 3–6 p. c., gaultherin, betulin.

Methylis Salicylas. Methyl Salicylate, $C_6H_4(OH)CO_2CH_3$ or $CH_3C_7H_5O_3$.—While this constitutes 98 p. c. of the commercial oils of gaultheria and betula, it is obtained largely synthetically by distilling salicylic acid, or a salicylate, with methyl alcohol and sulphuric acid (abstracting water as eliminated), the methyl salicylate distilling over and floating on the surface—$HC_7H_5O_3 + CH_3OH + H_2SO_4 = CH_3C_7H_5O_3 + H_2O + H_2SO_4$. It is a colorless, yellowish, reddish liquid, characteristic odor and taste of gaultheria, soluble in 70 p. c. alcohol (7), with not more than slight cloudiness, slightly in water, miscible with alcohol and glacial acetic acid; alcoholic solution neutral, slightly acid, sp. gr. 1.183 (synthetic), 1.177 (from gaultheria or betula); boils at 221° C. (430° F.); optically inactive (synthetic and

Fig. 299.—*Gaultheria procumbens.*

betula), slightly levorotatory (gaultheria); contains 98 p. c. of methyl salicylate. *Tests:* 1. Shake a drop with 5 cc. of distilled water, + a drop of ferric chloride T. S.—deep violet color. 2. Agitated 1 cc. with potassium hydroxide T. S. 10 cc.—clear, slightly cloudy, colorless or faintly yellowish, without separation of oily drops (abs. of other volatile oils, petroleum products). *Impurities:* Heavy metals, volatile oils, petroleum products. The label must indicate definitely its specific source. Should be kept cool, in well-stoppered, amber-colored bottles. Dose, ♏j-10 (.06–.6 cc.).

Preparations.—1. *Emulsum Olei Morrhuæ,* $\frac{2}{5}$ p. c. 2. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{50}$ p. c. 3. *Syrupus Sarsaparillæ Compositus,* $\frac{1}{50}$ p. c. 4. *Cataplasma Kaolini, N.F.,* $\frac{1}{5}$ p. c. 5. *Denti-*

ERICACEÆ

fricium, *N.F.*, $\frac{8}{10}\frac{7}{0}\frac{5}{0}$ p. c. 6. *Inunctum Mentholis Compositum*, *N.F.*, 10 p. c. 7. *Liquor Antisepticus*, *N.F.*, $\frac{1}{10}\frac{2}{0}$ p. c. 8. *Liquor Antisepticus Alkalinus*, *N.F.*, $\frac{1}{20}$ p. c. 9. *Liquor Ferri Salicylatis*, *N.F.*, $\frac{1}{5}$ p. c. 10. *Liquor Pepsini Antisepticus*, *N.F.*, $\frac{1}{20}$ p. c. 11. *Nebula Aromatica*, *N.F.*, $\frac{1}{2}$ p. c. 12. *Nebula Mentholis Composita*, *N.F.*, $\frac{1}{2}$ p. c. 13. *Odontalgicum*, *N.F.*, 45 p. c. 14. *Petroxolinum Methylis Salicylatis*, *N.F.*, 20 cc. in 100 cc. product. 15. *Syrupus Trifolii Compositus*, *N.F.*, $\frac{1}{50}$ p. c. 16. *Trochisci Ulmi*, *N. F.*, $\frac{1}{33}$ p. c,

Unoff. Preps.: Oil of Gaultheria (Br.), ♏j–10 (.06–.6 cc.). *Spirit*, 5 p. c., ℥j–2 (4–8 cc.).

Fig. 300.—*Chimaphila umbellata:* upper part of flowering stem.

Properties and Uses.—Similar to salicylic acid: Antiseptic, analgesic, stimulant, carminative, flavoring; muscular rheumatism, lumbago, sciatica; locally applied upon lint over swollen joints, acute articular rheumatism, tic douloureux, etc. Amount may be increased, if no impairment of digestion, until full effect produced.

Poisoning: Large quantities produce drowsiness, cerebral congestion, delirium, gastric irritability, vomiting, purging, intestinal pain, rapid pulse, hot dry skin, difficult breathing; give diffusible stimulants —ether, alcohol, ammonia, etc.

Gaultheria (Leaves), U.S.P. 1820–1880; *Oleum Gaultheriæ*, U.S.P. 1820–1900; *Oleum Betulæ* (*Volatile*), U.S.P. 1890–1900.

Allied Plants:

1. *Chimaph'ila umbella'ta, Chimaphila, Pipsissewa, Princes' Pine.*—Pyrolaceæ, *N.F.*—The dried leaves with not more than 5 p. c. of stems or other foreign organic matter; N. America, Europe, Asia—dry woods. Perennial evergreen herb, 10–25 Cm. (4–10′) high; rhizome creeping, yellowish; flowers terminal umbel, corymb, white tinged with red, fragrant. Leaves, oblanceolate, 2.5–7 Cm. (1–3′) long, 8–20 Mm. ($\frac{1}{3}$–$\frac{4}{5}$′) broad, upper portion coarsely, sharply serrate, obtuse, lower cuneiform, nearly entire, coriaceous, dark green, paler beneath; odor slight; taste astringent, bitter. Powder, greenish-brown—epidermal tissue, stomata, palisade and spongy parenchyma with chloroplastids, tracheæ, reddish amorphous substance, calcium oxalate rosettes, starch grains, few stem and root-stock fragments; solvents: diluted alcohol, boiling water; contains chimaphilin, tannin, arbutin, ericolin, urson, volatile oil, resin. Astringent, tonic, diuretic (similar to buchu, uva ursi, pareira, scoparius), rubefacient; scrofula, rheumatism, dropsy, scanty urine, gravel, hematuria, gonorrhea, skin affections, diarrhea, gout, ulcers, tumors. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Chimaphilæ* (diluted alcohol), dose, ʒss–1 (2–4 cc.); 2. *Fluidextractum Stillingiæ Compositum*, 12.5 p. c.: Prep.: 1. *Syrupus Stillingiæ Compositus*, 25 p. c. Decoction, Extract.

2. *C. macula'ta, Spotted Wintergreen* (*Pipsissewa*).—The leaves, U.S.P. 1830; N. America. Herb, 7.5–15 Cm. (3–6′) high, leaves 2.5–5 Cm. (1–2′) long, 12 Mm. ($\frac{1}{2}$′) wide, ovate-lanceolate, obtuse at base, toothed, upper surface variegated (spotted) with white along midrib and veins; flowers purplish-white.

3. *Pyr'ola rotundifo'lia, Round-leaved Wintergreen; P. ellip'tica. Shin-leaf*, and *P. chloran'tha, Greenish-flowered Wintergreen.*—These three have racemes of nodding wax-like flowers; leaves resembling and containing same as *Chimaphila umbellata*, and used similarly.

UVA URSI. UVA URSI, *U.S.P.*

Arctostaphylos Uva-ursi, (*Linné*) *Sprengel.* { The dried leaf with not more than 5 p. c. stems or other foreign organic matter.

Habitat. Europe, Asia, N. America, United States, south of New Jersey, westward to California, New Mexico; rocky or sandy soil—pine woods.

Syn. Bearberry, Red Bearberry, Upland (Mountain, Wild) Cranberry, Universe Vine, Mountain Box, Bear's Grape (Bilberry, Whortleberry), Barren Myrtle, Kinnikinnick, Fox (Meal) berry; Br. Uvæ Ursi Folia; Fr. Busserole, Raisin d'Ours; Ger. Bärentraubenblätter.

Arc-to-staph'y-los. L. fr. Gr. ἄρκτος, a bear, + σταφυλή, a bunch of grapes—*i. e.*, the roughness of the fruit and these berries occurring in clusters like grapes.

U'va-ur'si. L. *uva*, a grape, + *ursus, ursi*, a bear, of a bear—bear-berry—*i. e.*, berries are rough or bearish.

Plant.—Low evergreen shrub; stem creeping, young branches rising obliquely upward several inches; flowers May, 3–15 together, pinkish-white, racemes, calyx reddish, corolla urceolate, reddish-white or white

with red lips; fruit autumn, 6 Mm. ($\frac{1}{4}'$) broad, fleshy, bright red berry, pericarp thick, 5-seeded, resembles currants in appearance and clusters. LEAVES (LEAF), obovate, oblong-spatulate, 12–30 Mm. ($\frac{1}{2}$-$1\frac{1}{5}'$) long, 5–13 Mm. ($\frac{1}{5}$–$\frac{1}{2}'$) broad, entire, slightly revolute, apex obtuse, rounded, base cuneate, tapering into short, stout petiole; dark green, glaucous, shiny, finely reticulate; under surface yellowish-green, slightly pubescent, especially on midrib, coriaceous; fracture short; odor aromatic, tea-like; taste astringent, somewhat bitter. POWDER, olive-green—irregular fragments, epidermal cells polygonal, elliptical stomata surrounded by 5–18 neighboring cells, mesophyll with chloroplastids, irregular masses of carbohydrates, fibro-vascular bundles, spiral tracheæ, sclerenchymatous fibers, crystal-fibers, cells with yellowish-brown content, bluish-black with ferric chloride T. S. *Tests:* 1. Cover over .1 Gm. (powder) on watch-crystal with another watch-crystal, heat gently—crystalline sublimate (hydroquinone) forms in long rods, feather-like aggregates, polarizing light with brilliant colors. 2. Macerate 1 Gm. with boiling water 10 cc., shake occasionally until cold, filtrate with a few drops of ferrous sulphate T. S.—grayish-purple precipitate; collect in autumn. *Solvents:* diluted alcohol; boiling water. Dose, gr. 15–60 (1–4 Gm.).

FIG. 301.—*Arctostaphylos Uva-ursi.*

ADULTERATIONS. — *Vaccin'ium Vit'is-Idæ'a, Wineberry, Cowberry, Red Whortleberry*—leaves resemble uva ursi, but blackish, bristly points on under surface, and *V. uligino'sum, Bog Whortleberry, Great Bilberry*—leaves crenate, much thinner, under surface pubescent; *Den'drium* (*Leiophyl'lum*) *buxifo'lium, Sand Myrtle*, N. J., southward; small shrub, leaves oval, shining, margin revolute, reticulate; *Bux'us semper'virens, Box, Bush-tree Dudgeon*, cultivated in gardens, leaves ovate, narrower toward apex than near the base; contain buxine and parabuxine (both giving bitterness), tannin, volatile oil, bitter extractive; *Epigæ'a re'pens, Trailing Arbutus* (*Mayflower, Ground Laurel, Gravel Plant*), and *Chimaphila umbellata, Pipsissewa;* leaves resemble and both contain the three active constituents of uva ursi; used in lithic acid gravel. Dose, gr. 15–60 (1–4 Gm.).

CONSTITUENTS.—Arbutin. $C_{12}H_{16}O_7$, Ericolin, $C_{34}H_{56}O_{22}$, Urson, $C_{10}H_{16}O$, Tannin 6–7 p. c., ericinol, $C_{10}H_{16}O$, gallic acid, ellagic acid, coloring matter, ash 3 p. c.

Arbutin.—A glucoside obtained by precipitating the decoction with lead subacetate, treating filtrate with hydrogen sulphide, and evaporating to crystallize. It is in needles, bitter, soluble in alcohol or hot water, insoluble in ether, blue with diluted ferric chloride; with sulphuric acid yields glucose, arctuvin (hydroquinone), $C_6H_6O_2$, and methyl-hydroquinone, $C_7H_8O_2$. Dose, gr. 3–5 (.2–.3 Gm.).

Ericolin.—This is left in the mother-liquor from arbutin; it is a bitter glucoside, yellow, soluble in water, alcohol; yields glucose and ericinol (volatile oil).

FIG. 302.—*Arctostaphylos Uva-ursi:* Section of leaf epidermis (lower surface) showing large stomata.

Ursone.—Crystalline principle, resinous, obtained by exhausting with ether, evaporating, recrystallizing from alcohol; occurs in tasteless needles, insoluble in water, sparingly in alcohol, ether.

PREPARATIONS.—1. *Fluidextractum Uvæ Ursi.* Fluidextract of Uva Ursi. (Syn., Fldext. Uvæ Ursi, Fluid Extract of Uvæ Ursi; Fr. Extrait fluide de Busserole; Ger. Bärentraubenblätterfluidextrakt.)

FIG. 303. — *Arctostaphylos Uva-ursi:* Bast-fibers and parenchyma from part of leaf without chlorophyll, containing a single crystal.

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st menstruum: water 50 cc., alcohol 30, glycerin 10; 2d menstruum: 33 p. c. alcohol; reserve first 80 cc. Dose, ♏xv–60 (1–4 cc.).

Unoff. Preps.: Decoction, dose, ʒj–2 (30–60 cc.). *Extractum Uvæ Ursi* (alcohol 30 p. c.), dose, gr. 5–15 (.3–1 Gm.). *Infusum Uvæ Ursi* (Br.), 5 p. c., dose, ʒss–2 (15–60 cc.).

ERICACEÆ

PROPERTIES.—Astringent, diuretic, nephritic, tonic, disinfectant (due to the hydroquinone formed); large doses vomit, purge, oxytocic.

USES.—Cystitis, gravel, chronic nephritis, urethritis, incontinence of urine, dysuria, strangury, uterine hemorrhage, gleet, leucorrhea, menorrhagia, urinary calculi, bronchitis, diarrhea, cardiac dropsy.

Allied Plants:

1. *Arctostaphylos glau'ca, Manzanita.*—California mountains, small tree; leaves 5 Cm. (2′) long; contains arbutin, tannin 10 p. c., ash 6 p. c. *A. polifo lia* and *A. mucrocif'era*, Mexico; both used like uva ursi.

2. *Kal'mia latifo'lia, Mountain Laurel, Calico-bush.*—About 1.8–9 M. (6–30°) high; flowers inodorous, May–June; leaves evergreen, elliptical; contains tannin, arbutin, resin, andromedotoxin, $C_{31}H_{51}O_{10}$. Astringent; large doses poisonous.

3. *Limo'nium carolinia'num* (*Stat'ice Limo'nium* var. *carolinia'na*), *Marsh Rosemary.*—Plumbaginaceæ. The root, U.S.P. 1830–1870; N. America. Plant a maritime perennial, acaulescent; leaves 2.5–4 Cm. (1–1⅗′) long, obovate, cuneiform, entire, mucronate, scape .3–.6 M. (1–2°) high, terete, corymbose panicles; flowers lavender color; root .3–.6 M. (1–2°) long, 2.5 Cm. (1′) thick, annulate, wrinkled, purplish-brown, astringent, bitter; contains tannin 14–18 p. c., volatile oil, resin. Astringent like catechu or kino; aphthous and ulcerative affections of the mouth, fauces, hemorrhages, dysentery; in decoction, infusion, tincture. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 304.—*Palaquium Gutta.*

4. *Pala'quium Gut'ta*, and *P. oblongifo'lium, Gutta-percha.*—Sapotaceæ. The purified, coagulated, milky exudation, U.S.P. 1860–1880; Malayan Peninsula and Islands, Singapore, Borneo. Tree, 18–21 M. (60–70°) high, .6–1 M. (2–3°) thick; bark reddish-gray; leaves 10–12.5 Cm. (4–5′) long, tomentose, silky beneath; flowers yellowish. Gutta-percha is obtained by incisions, or by felling trees, removing bark, and catching juice in plantain-leaf stalks, palm leaves, or cocoanut shells; it soon coagulates and occurs in yellowish, grayish masses, hard, heavier than water, flexible, plastic at 50° C. (122° F.), decomposes on melting; inodorous; tasteless; soluble in ether, chloroform, oil of turpentine, carbon disulphide; contains gutta, $C_{20}H_{32}$, 80 p. c., fine white powder; fluavil, $C_{20}H_{32}O$, yellow resin; albane, $C_{20}H_{32}O_2$, white resin. Used in surgery for splints, catheters, bougies, specula, pessaries, syringes, etc. *Liquor Guttæ Perchæ*, U.S.P. 1860–1880, 15 p. c., + lead carbonate 17, chloroform q. s. 100; employed as an adhesive and protective agent for wounds, abrasions, skin affections, sore nipples, erysipelas, smallpox, etc.

5. *Dios'pyros virginia'na, Persimmon.*—Ebenaceæ. The unripe fruit dried, U.S.P. 1820–1870; United States. Tree, 6–21 M. (20–70°) high, much smaller northward; wood hard, blackish; leaves 7.5–12.5 Cm. (3–5′) long, entire, glaucous beneath, elliptical; flowers yellowish; fruit plum-like, 2.5 Cm. (1′) thick, green, 4-lobed calyx at base; short style at apex, 6-celled, 6-seeded; taste astringent, when ripe orange-red, by frost sweet, edible; contains tannin, malic acid. Astringent for diarrhea, chronic dysentery, uterine hemorrhage, leucorrhea, sore throat; in infusion, tincture, syrup. Dose, gr. 15–60 (1–4 Gm.). Persimmon beer, made by fermenting ripe fruit with hop, as a beverage, and the bark as tonic and astringent, are popular to some extent.

53. STYRACEÆ. Storax Family.

Sti-ra'se-e. L. *Styr-ax(ac)* + aceæ, Gr. *στύραξ*, a tree yielding gum, an alteration of native Ar. name *Assthirak*. Trees, shrubs. Distinguished by yielding stimulant balsamic resins; calyx 4–8-cleft, inferior; corolla 4–8-lobed; stamens equal or twice the petals, united at base; ovary 2–5-celled, each 1-seeded, style 1; fruit, berry or drupe, fleshy; tropics, temperate climates; stimulant; resins, dyes.

Genus: **1. Styrax.**

BENZOINUM. BENZOIN, *U.S.P.*

Styrax Benzoin, *Dryander,* or other species. { The balsamic resin with not more than 1 p. c. foreign organic matter (Siam), yielding 75 (Sumatra)–90 (Siam) p. c. alcohol-soluble extractive and 1 (Sumatra)–.5 (Siam) p. c. acid-insoluble ash.

Habitat. East Indies—Sumatra, Siam, Java, Borneo, Malay Peninsula, Laos; cultivated; grown upon interior hills and sea coast plantations.

Syn. Gum Benjamin, Benzoin Laurel, Benjamin tree, Resina Benzoe, Asa Dulcis; Fr. Benjoin (de Sumatra); Ger. Benzoë, Benzoe.

Sty'rax. L. see etymology, above, of Styraceæ.

Ben-zo-i'num. L. fr. Ar. *luban, jawa,—lu* + *ban* + *join,* contracted, lit. "incense of Java," in universal use.

Ben-zo'in. The original word and mostly used.

Plant.—Handsome tree, medium height, with dense spreading crown; bark grayish, tomentose; leaves oblong, downy, 7.5–12.5 Cm. (3–5′) long, acuminate, dentate; flowers inside reddish, outside white, hairy, anthers 2-celled. Balsamic resin: *Sumatra Benzoin*, in blocks, lumps of variable size made up of tears compacted together with reddish-brown resinous mass; tears yellowish-brown, fresh fracture milky-white; hard, brittle, softened by heat; odor aromatic, when boiled with water suggesting cinnamic acid or storax; taste aromatic, slightly acrid—gritty on chewing; *Siam Benzoin*, in pebble-like tears of variable size, compressed, yellowish-brown, separate or slightly

agglutinated, fracture milky-white, hard, brittle, softened by heat; odor agreeable, balsamic, vanilla-like; taste aromatic, slightly acrid—plastic on chewing. *Tests:* 1. Alcohol dissolves 75 (Sumatra)–90 (Siam) p. c., the solution being acid, and milky with water. 2. Heat fragments in test-tube—sublimate formed just above melted mass, in plates, small rod-like crystals strongly polarizing light (Sumatra), or in long rod-shaped crystals slightly polarizing light (Siam). 3. Ethereal solution added to small quantity of sulphuric acid—brownish-red (Sumatra), purplish-red (Siam). 4. Heat .5 Gm. with potassium permanganate T. S. 10 cc.—Sumatra only develops odor of benzaldehyde. 5. Treat 1 Gm. with warm carbon disulphide 15, + 5 cc. filtrate spontaneously evaporated—residue not over 12.5 p. c., and responds to tests of benzoic acid. *Impurities:* Rosin, foreign resins, etc. Dose, gr. 5–30 (.3–2 Gm.).

Adulterations.—Wood, bark, splinters, earthy matter, stones, resinous matrix (in cake benzoin—remaining behind when treated with alcohol or sublimed), 10–40 p. c.

Commercial.—Trees contain no resin-receptacles and only the unhealthy afford resin—a pathological product (tannate transformation resulting from wounding)—which is obtained, July–Nov., from both wild and cultivated plants over 6 years old having a trunk 15–20 Cm. (6–8′) thick, by making between the ground and the first branches longitudinal or oblique incisions, or a circle of notches through the bark into which the white liquid resin slowly exudes; after 3 months, when dry and hard (concreted), it is picked out, cut or scraped off with knives or sharp sticks, placed into baskets, and assorted according to size, cleanness, and quality, the larger tears (marbles, almonds) commanding the higher price. Each tree yields annually about 3 pounds (1.5 Kg.) for 12 years, when they are cut down; the first 3 years' product, called natively *head benzoin*, is best, being more fragrant and filled with white tears; the next 7–8 years' yield, *belly benzoin*, is browner, with less white tears, while by felling the trees and splitting the stems an inferior quality, *foot benzoin*, "*foots*," is scraped off, being dark and mixed with wood, bark, etc. These names correspond to our *superior*, *medium*, *inferior*—both having the same relative values, 105, 45, 18. It is received at the Sumatra ports in cakes wrapped in matting, there softened by heat, packed into chests, and sent to Penang and Singapore, thence into commerce; in Siam it is conveyed on bullocks' backs to Menam River, thence via Bangkok to market in cubical blocks. There are five varieties—the first two being recognized by U.S.P.: 1, *Sumatra*, grayish-brown, with many white tears mixed with resinous matrix of unknown origin, reddish-brown with age; 75 p. c. soluble in alcohol, odor weak, storax-like; inferior kinds with few or no tears, but many chips of wood, bark, etc., especially in the center—"drossy" or "false packed;" 2, *Siam*, best, reddish-brown, in small or large tears; 90 p. c. soluble in alcohol, odor strongest, most agreeable, vanilla-like, taste bitter; occurs in two forms:

(*a*) tears—almond-shaped lumps, often 2.5 Cm. (1′) long, more or less flattened; (*b*) amygdaloid—tears agglutinated with reddish-brown matrix; 3, *Penang*, similar to Sumatra, but odor even more storax-like, and possibly from other species of *Styrax;* 4, *Palembang*, free from tears, pale reddish-brown, opalescent luster (due to moisture, becoming moldy), little odor; contains benzoic acid, no cinnamic acid nor vanillin; tincture gives flocculent precipitate, not milkiness, in water; seldom reaches our market; 5, *False* (*Catappa—Bu'ceras* (*Termina'lia*) *angustifo'lius*—Combretaceæ); whitish-brown aromatic exudate obtained by incisions, resembles benzoin slightly; used as incense in E. India. While the quality of all varieties depend upon the amount of tears, yet the Sumatra is the great article of commerce, although the Siam is purest, least variable, and best flavored.

Fig. 305.—*Styrax Benzoin: 1.* flowering twig; *2*, vertical section of flower; *3*, diagram of the flower; *4*, fruit, with upper portion laid bare, showing channeled surface; *5*, anther; *6*, seed, longitudinal section.

Constituents.—Sumatra: Benzoic acid 10–20 p. c., Cinnamic acid, small amount or wanting, Resins, Vanillin .1–1 p. c., volatile oil (benzoic acid ester—aromatic, neutral) .3 p. c., styracin 2–3 p. c., styrol, benzaldehyde, phenyl-propyl cinnamate, 2 esters 75 p. c. (of which 92.6 p. c. is resinotannol, 7.4 p. c. benzoresinol)—yielding cinnamic acid 33 p. c.; Siam: less benzoic acid, little or no cinnamic acid, more vanillin, 1–1.5 p. c., benzoresinol benzoate, $C_{16}H_{26}O$, 5 p. c. (long white prisms), resinotannol benzoate, $C_{12}H_{14}O_3$, 57 p. c., ash 2 (Sumatra) –2.5 (Siam) p. c.

Acidum Benzoicum. Benzoic Acid, C_6H_5COOH, *U.S.P.*—(Syn., Acid Benz., Acidum Benzoicum Sublimatum, Flores Benzoes, Flowers of Benzoin; Fr. Acide benzoïque, Fleurs de Banjoin; Ger. Benzoesäure,

Benzoeblumen.) This organic acid—*English* variety, is obtained (*wet process*) by boiling benzoin several hours with milk of lime, filtering while hot, supersaturating filtrate with hydrochloric acid, allowing to crystallize, purifying; or more frequently (*dry process*) by the sublimation of benzoin (sometimes having an equal weight of sand added) between the temperatures 140–180° C. (284–366° F.). It is made also from hippuric acid (horse and cattle urine, furnishing the *German benzoic acid*), as well as synthetically from phthalic acid (naphthalene), but chiefly for commercial purposes, artificially from toluene (toluol), $C_6H_5CH_3$, by passing chlorine into it (boiling) until ceasing to gain weight, thereby converting it first into benzo-trichloride, and then treating this with water under pressure—$C_6H_5CCl_3 + 2H_2O = C_6H_5$-$COOH + 3HCl$; it is in lustrous scales, friable needles; natural—white, yellowish, darker on exposure to light, slight odor of benzoin; synthetic —white, odorless, slight odor of benzaldehyde; pungent acid taste, somewhat volatile at moderate temperature, freely with steam; soluble in water (275), boiling water (18), alcohol (2.3), boiling alcohol (1.5), chloroform (4.5), ether (3), benzene (10), carbon disulphide or tetrachloride (30), oil of turpentine (33), solutions of alkali hydroxides, fixed and volatile oils, sparingly in petroleum benzin; melts at 120° C. (248° F.); saturated solution acid; contains not less than 99.3 p. c. of C_6H_5COOH; the sublimed is most soluble in water and contains volatile oil imparting odor; melts at 121° C. (250° F.); ash— .05 p. c. *Tests:* 1. Warm for 5 minutes .1 Gm. synthetic acid + sulphuric acid 2 cc.—not darker than light yellow, acid from benzoin—light brown (abs. of readily carbonizable substances). 2. Dissolve .3 Gm. in hot water 15 cc., + $\frac{N}{10}$ potassium permanganate—no odor of benzaldehyde (dif. from cinnamic acid). *Impurities:* Chlorinated compounds, cinnamic acid, readily carbonizable substances. Should be kept cool, dark, in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Cinnamic Acid, $C_9H_8O_2$.—Obtained by agitating filtered ethereal solution with weak sodium hydroxide solution (to remove benzoic acid and vanillin), distilling off ether, saponifying pure esters by boiling with sodium hydroxide solution several hours, acidifying, boiling, filtering, cooling, when crystals appear. The two acids may be separated by their different degree of volatility, benzoic acid melting at 121.4° C. (250.5° F.) and the two mixed (1 cinnamic, 2 benzoic) at 25.5° C. (78° F.).

Resins.—One is extracted along with benzoic acid by boiling solution of potassium carbonate in excess; another is dissolved from the residue by ether, while the third is affected by neither solvent, hence left as a residue. With melted potassium hydroxide get paroxybenzoic acid, $C_7H_6O_3$, protocatechuic acid, $C_7H_5O_4$, and pyrocatechin, $C_6H_6O_2$.

Vanillin, $C_8H_8O_3$.—Is obtained by treating Siam benzoin with caustic lime, precipitating benzoic acid with hydrochloric acid and shaking liquid with ether.

PREPARATIONS.—I. BENZOIN: 1. *Adeps Benzoinatus.* Benzoinated Lard. (Syn., Adeps Benz., Benzoated Lard, Unguentum Benzoini, Axungia Balsamica—Benzoinata or Benzoata; Br. Adeps Benzoatus; Fr. Axonge benzionée; Ger. Adeps Suillus Benzoinatus, Benzoe (Benzoinirtes)-schmalz.)

Manufacture: 1 p. c. Melt lard 100 Gm. on water-bath, add Siam benzoin, in coarse powder, 1 Gm., mix thoroughly, heat gently, 60° C. (140° F.), for 2 hours, covering the vessel, strain, stir occasionally while cooling; when for hot-weather use, may replace 5 p. c. (or more) of the lard by white wax Should be kept cool, in well-closed containers impervious to fat.

Preps.: 1. *Ceratum*, 70 p. c. 2. *Ceratum Cantharidis*, 20 p. c. 3. *Unguentum*, 80 p. c. 4. *Unguentum Hydrargyri Fortius*, 25 p. c. 5. *Unguentum Sulphuris*, 85 p. c. 6. *Ceratum Camphoræ N.F.*, 40 p. c. 7. *Mulla Acidi Salicylici, N.F.*, 10 p. c. 8. *Mulla Hydrargyri Chloridi Corrosivi, N.F.*, 5 p. c. 9. *Mulla Zinci, N.F.*, 20 p. c. 10. *Pasta Zinci Sulphurata, N.F.*, 70 p. c. 11. *Unguentum Plumbi Iodidi, N.F.*, 90 p. c. 12. *Unguentum Potassii Iodidi, N.F.*, 80 p. c. 13. *Unguentum Stramonii, N.F.*, 65 p. c. 14. *Unguentum Sulphuris Alkalinum, N.F.*, 65 p. c. 15. *Unguentum Veratrinæ, N.F.*, 90 p. c.

2. *Tinctura Benzoini.* Tincture of Benzoin. (Syn., Tr. Benz.; Fr. Teinture de Benjoin; Ger. Tr. Benzoes, Benzoetinktur.)

Manufacture: 20 p. c. Similar to Tinctura Cardamomi Composita, page 137; menstruum: alcohol. Dose, ʒss–1 (2–4 cc.); largely externally.

Prep.: 1. *Unguentum Picis Compositum, N.F.*, 2 p. c.

3. *Tinctura Benzoini Composita.* Compound Tincture of Benzoin. (Syn., Tr. Benz. Co., Friar's or Turlington's Balsam, Tinctura Balsamica, Balsamum Commendatoris, Elixir Traumaticum; Fr. Teinture balsamique, Baume du Commandeur de Permes; Ger. Persischer Wundbalsam.)

Manufacture: 10 p. c. Similar to Tinctura Cardamomi Composita, page 137—using benzoin 10 Gm., aloe 2, storax 8, tolu 4; menstruum: alcohol. Dose, ʒss–1 (2–4 cc.); mostly externally.

4. *Sevum Benzoinatum, N.F.*, 3 p. c.

Preps.: 1. *Mulla Acidi Salicylici, N.F.*, 80 p. c. 2. *Mulla Creosoti Salicylata, N.F.*, 65 p. c. 3. *Mulla Hydrargyri Chloridi Corrosivi, N.F.*, 90 p. c. 4. *Mulla Zinci, N.F.*, 70 p. c.

II. BENZOIC ACID: 1. *Tinctura Opii Camphorata*, $\frac{2}{5}$ p. c.

Unoff. Prep.: Benzoic Acid Lozenge (Br.), each $\frac{1}{2}$ gr. (.03 Gm.).

PROPERTIES.—Stimulant, expectorant, antiseptic, diuretic, antipyretic. It is eliminated slightly by the skin, salivary glands, and broncho-pulmonary mucous membrane, but mostly by the kidneys, where it is converted into hippuric acid, which renders alkaline urine acid, increases the flow, disinfects and stimulates the genito-urinary tract.

OLEACEÆ

USES.—Chronic laryngitis, diarrhea, dysentery. Locally the tincture as a stimulant and protective to wounds, to arrest coryza. Benzoic acid—for bronchitis, uric acid deposits, cystitis, acute gonorrhea, phosphatic gravel, incontinence of urine, rheumatism. Bright's disease, albuminuria, dressing to wounds, ulcers.

Incompatibles: The tinctures with all aqueous preparations.

54. OLEACEÆ. Olive Family.

O-le-a'se-e. L. *Ole-a* + aceæ, Gr. ἐλαία, olive tree, ἔλαιον, *oleum*, oil—*i. e.*, referring to the oleaginous fruit. Trees, shrubs. Distinguished by stamens 2–4, inserted on corolla; ovary 2-celled, superior; ovules 2 in each cell; calyx and corolla 4–8 cleft, regular; fruit capsule, samara, berry or drupe, often 1-seeded; temperate climates, tropics; tonic, febrifuge, purgative, perfumery (vol. oil), fragrant flowers; hardwood, dye.

Genera: **1. Fraxinus. 2. Olea.**

MANNA. MANNA, *U.S.P.*

Fraxinus Ornus, *Linné.* { The dried exudation yielding not less than 75 p. c. of anhydrous alcohol-soluble extractive, when extracted with boiling 90 p. c. alcohol.

Habitat. Mediterranean Basin, Asia Minor to Spain; Sicily, France, Italy.

Syn. Manna (Flowering) Ash, European Manna Tree; Fr. Manne en Larmes; Ger. Manna.

Frax'i-nus. L. for ash tree, fr. Gr. φράσσω—ξω, to fence in, enclose—*i. e.*, the wood used for making hedges or fences, thus protecting things and places.

Or'nus. L. Wild Ash, fr. Heb. *oren*, Gr. ορείνος—*i. e.*, the classic name for wild mountain ash.

Man'na. L. fr. Gr. μάννα, Heb. *man*, Ar. *mann*, gift (of heaven)—divinely supplied food—*i. e.*, to the Israelites in their journey through the wilderness of Arabia.

PLANT.—Small tree, 4.5–7.5 M. (15–25°) high; stem slender, bark gray, with leaf-scars on young twigs; leaves imparipinnate, 15–20 Cm. (6–8′) long; leaflets 4 pairs, 2.5–5 Cm. (1–2′) long, oval, acuminate, serrate, bright green, petiolate; flowers May–June, small, numerous, white, panicles, petals, 4 Mm. ($\frac{1}{6}$′) long; fruit samara, 2.5 Cm. (1′) long, 4 Mm. ($\frac{1}{6}$′) broad. EXUDATION (manna), in irregular, more or less elongated, flattened, 3-sided pieces, yellowish-white, friable; internally nearly white, porous and crystalline in appearance; odor slight, characteristic; taste sweet, slightly bitter, faintly acrid; also in irregular masses, partly brittle or soft fragments, yellowish-white, yellowish-gray—the latter at least, to the extent of 40 p. c. *Test:* 1. Heat to boiling 5 Gm. with alcohol 100 cc.—filtrate on cooling rapidly deposits crystals of mannite. *Solvents:* hot or cold water; alcohol. Dose, ʒj–8 (4–30 Gm.).

Adulterations.—Products of allied species, bread crumbs, starch, glucose, wood, bark, etc.

Commercial.—The manna ash was introduced into Europe, 1710, and is so graceful as to be planted often in gardens for ornament. In Sicily whole plantations are cultivated for the juice, which is obtained from trees, at least 8 years old and stem 7.5–10 Cm. (3–4′) thick, by cutting through the bark to the wood with a curved knife

Fig. 306.—*Fraxinus Ornus:* branch showing leaves and flowers.

transverse incisions, 2.5–5 Cm. (1–2′) long, and 2.5 Cm. (1′) apart, the first cut being nearest the ground, and another made directly above it every day during warm weather, July–August. The next year another portion of the stem is used, so continuing 10–12 seasons, when the trees, being spent, are felled and shoots allowed to spring from the stump. Manna exudes from these incisions as a clear liquid, soon concretes on the stem, or on sticks and straws placed in the incisions for the purpose, is dried upon shelves, and packed for market

in tin-lined deal boxes having partitions. There are three varieties: 1, *Large Flake* (*Manna Cannellata, Electa*), obtained when juice abundant from upper incisions, giving a product less fatty, in consequence of which it dries easily in tubes or flat pieces—the very best, *Manna a cannola*, on sticks, straws inserted in the cuts, being unknown in our market; 2, *Small Flake* (*Manna in tears, lachrymis*), same as preceding, only smaller and often of darker shade; 3, *Sorts* (*Tolfa, Manna Communis*), in tears from lower incisions, into which leaves, etc., are placed for it to congeal upon; it is inferior, more gummy, sticky, brownish, internally whitish, less crystalline, some being scraped from trees; 4, *Fat* (*Manna Pinguis*), flows down the trunk, Oct.-Nov., fragments united by brown viscid matter, without flakes; rarely seen in market or used in medicine.

a *b* *c*

FIG. 307.—*Fraxinus Ornus: a*, flower opened; *b*, single-winged fruit; *c*, longitudinal section of same.

CONSTITUENTS.—Mannite 60–90 p. c., Glucose, sucrose, mucilage, fraxin, resin.

Mannite, $C_6H_8(OH)_6$.—Obtained with boiling alcohol and recrystallizing from the same several times; occurs in white prisms, soluble in water (6), slightly in absolute alcohol, insoluble in ether, sublimes at 200° C. (392° F.) mostly into mannitan, $C_6H_{12}O_5$, a sweetish, syrupy liquid, by oxidation gives fermentable mannitose and various acids.

Glucose.—Sometimes 16 p. c. **Mucilage** and **Fraxin,** $C_{22}H_{36}O_{20}$, are mostly in inferior grades; to this latter are due the fluorescence of the aqueous solution and the green color seen in some manna.

PREPARATIONS.—1. *Syrupus Mannæ, N.F.*, 12.5 p. c. + sucrose 77.5, alcohol 6.5, hot water q. s. 100. Dose, ʒj–2 (4–8 cc.). 2. *Infusum Sennæ Compositum, N.F.*, 12 p. c.

PROPERTIES.—Laxative, demulcent, expectorant, cholagogue, may cause flatulence and colic; action slow and constringes secondarily.

USES.—Usually given with other medicines, as senna, rhubarb, magnesium oxide, neutral salts, etc., to which it adds purgative properties, and by its sweetness disguises disagreeable taste of its associate. Useful in piles, genito-urinary irritation, constipation of pregnancy; mostly given to children and delicate persons, to whom its sweetness appeals.

Allied Products:

1. *Fraxinus excel'sior, European Ash.*—S. Europe. Produces manna identical with the official.

2. *La'rix Larix* (*europæa*), *Briançon Manna* (Pinaceæ); *Quercus Vallo'nea, Armenian Manna* (Fagaceæ); *Alha'gi camelo'rum, Persian Manna* (Papilionaceæ); *Eucalyptus gonioca'lyx, E. Gun'ni* and *E. vimina'lis* (Myrtaceæ); *Tam'arix mannif'era, Tamarisk Manna* (Tamaricaceæ). All these produce sweet exudations or mannas (not met in commerce), containing melezitose, $C_{12}H_{22}O_{11}3H_2O$, or melitose, $C_{12}H_{28}O_{14}$, or some such saccharine principle. The saccharine products of some insects as *Trehala*, cocoon of *Lavi'nus mellif'icus* (Syria) and *Lerp*, upon *Eucalyptus dumosa* (Australia) contain trehalose, a sugar, and are used as manna.

Allied Plants:

1. *Fraxinus america'na, Fraxinus, White Ash Bark.*—United States; tree 18–24 M. (60–80°) high, durable, tough wood, 5–9 ovate, acuminate leaflets, terete fruit, 2.5–5 Cm. (1–2′) long, abruptly dilated into wedge-linear wing. Dried bark, deprived of corky layer—in flat pieces of varying length, 3–6 Mm. ($\frac{1}{8}$–$\frac{1}{4}$′) thick, yellowish, warty, inside pale brown, striate, fracture uneven, fibrous; odor faintly aromatic, taste bitter, acrid; contains volatile oil, resin, tannin, alkaloid (?), ash 10 p. c. Diuretic, diaphoretic, purgative; gout, rheumatism, intermittents. Dose, gr. 30–60 (2–4 Gm.); infusion, 5 p. c., ℥ss–1 (15–30 cc.).

2. *Chionan'thus virgin'ica, Chionanthus, Fringe Tree Bark, N.F.*—The dried root-bark with not more than 5 p. c. of wood and other foreign organic matter, yielding to 70 p. c. alcohol not less than 25 p. c. of non-volatile extractive; S. United States, river banks. Low tree or shrub, very ornamental in cultivation; leaves 5–6, oblong; fruit, purple ovoid drupe, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}$′) long, Bark, usually in transversely curved pieces, occasionally single quills, 1–10 Cm. ($\frac{2}{5}$–4′) long, 2–10 Mm. ($\frac{1}{12}$–$\frac{2}{5}$′) thick, heavy, some pieces sink in water, reddish-brown, transverse wrinkles, scaly, pits and ridges, whitish cork patches, root-scars, inner surface yellowish-brown, striate, undulate; fracture short, hard, coarsely granular (stone cells); odor characteristic; taste bitter. Powder, light brown—starch grains, numerous stone cells in groups or isolated, few short fibers, numerous resin masses, brownish cork cells, parenchyma tissue, prismatic crystals; solvent: water; contains bitter principle, tannin, ash 5 p. c. Alterative, blood purifier; liver trouble, syphilis; popular with Eclectics, Homeopaths. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Chionanthi* (75 p. c. alcohol). Decoction, Infusion, 5 p. c., ℥ss–1 (15–30 cc.).

OLEA. OLIVE.

Oleum Olivæ. Olive Oil, *U.S.P.*

Olea europæa, *Linné.* } A fixed oil obtained from the ripe fruit.

OLEACEÆ

Habitat. Asia, S. Europe (Spain, Portugal, Asia Minor, Syria, Italy, S. France), Algeria; cultivated in S. United States (Fla., Cal.), S. America.

Syn. Olive Gum, Lucca Gum, Olive (Bark) Leaves; Ol. Oliv., Sweet Oil; Fr. Huile d'Olive; Ger. Oleum Olivarum, Olivenöl.

O'le-a. L. olive, fr. Gr. ἐλαία, olive tree, *oliva*, the fruit, *oleum*, the juice or oil from the fruit.

Eu-ro-pæ'a. L. European—*i. e.*, its habitat.

Plant.—When wild a branched, thorny shrub; under cultivation a tree 3–9 M. (10–30°) high, resembling white willow; bark grayish-white; leaves 5–6 Cm. (2–2⅖′) long, lanceolate, acute, entire, coriaceous, glabrous, upper side glaucous-green, the lower silvery-white; flowers many, small, creamy-white, diandrous, racemes; fruit drupe, 12–25 Mm. (½–1′) long, ovoid, pointed, olive-green then deep purple, sarcocarp firm, fleshy, internally greenish and filled with oil; stone (putamen) thick, bony, ovoid, 1-seeded.

Fig. 308.—*Olea europæa.*

Constituents.—Fruit (sarcocarp): Fixed oil 70 p. c., water 25 p. c.

Oleum Olivæ. Olive Oil.—It is a pale yellow, light greenish-yellow, oily liquid, slight peculiar odor and taste, faintly acrid after-taste; slightly soluble in alcohol, miscible with ether, chloroform, carbon disulphide; sp. gr. 0.915; cooled from 10–8° C. (50–46° F.) somewhat cloudy from separation of crystalline particles, at 0° C. (32° F.) forms whitish, granular mass; contains olein 70 p. c., linolein 6 p. c., palmitin and arachin 28 p. c., phytosterin (unsaponifiable matter, once thought to be cholesterin), chlorophyll (from fruit, imparting greenish color). *Tests:* 1. Mix in test-tube 5 cc. with 5 cc. of equal vols. of amyl alcohol and carbon disulphide, containing 1 p. c. of precipitated sulphur in solution, immerse to one-third its depth in boiling, saturated aqueous sodium chloride solution—no reddish color in 15 minutes (abs. of cottonseed oil). 2. Mix 2 cc. with 1 cc. of hydrochloric acid containing 1 p. c. of sucrose, shake half a minute, let stand 5 minutes, add 3 cc. of distilled water, shake—acid layer shows no pink color (abs. of sesame oil). Should be kept cool, in well-closed containers. Dose, adult, ʒss–1 (15–30 cc.), when for gall-stones ʒviij–16 (240–480 cc.); infant, ʒj–2 (4–8 cc.), in emulsion.

Adulterations.—Chiefly cottonseed oil, also peanut, poppy, rape, and sesame oils, etc., rarely less than 25 p. c.; all of these congeal at much lower temperature, and do not solidify when shaken with mercuric nitrate (12), as does pure olive oil.

Commercial.—Tree is grown successfully in California, but our supply of oil comes solely from Europe, it being obtained by crushing

ripe fruit short of the putamen, subjecting marc, in coarse bags, to strong pressure, and running oil into vessels containing water, from which, after a few days subsidence, it is skimmed, thus constituting the first grade, *huile vierge—virgin oil;* the press-cakes are taken from the bags, finely broken up with hot water, and subjected to greater pressure, thereby removing both water and oil, the latter being drawn off from the surface, constituting *second-grade oil;* the remaining marc contains 9–12 p. c. of oil, which may be extracted by carbon disulphide, or by mixing with hot water in cisterns (enfer), and allowing partial fermentation, yielding on the surface a disagreeably smelling oil, *huile d'enfer;* sometimes inferior fruit is allowed to ferment in heaps or vats, giving by expression also an inferior oil, *huile fermentée.* In order to combine perfume, fineness, and sweetness the oil must be from fruit slightly ripe, and then stored 6–8 months, until the strong flavor has disappeared; it enters commerce in bottles, jugs, and barrels, under the brands: Provence, Florence, Gallipoli, Spanish, Sicily—the best from S. France, the most from Italy (one-half), and Spain (one-fifth).

PREPARATIONS.—1. *Sapo.* Soap. (Syn., Olive Oil Castile Soap, Sodium Oleate; Br. Sapo Durus, Hard Soap; Fr. Savon Médicinæ, Savon blanc d'Espagne; Ger. Sapo medicatus—(hispanicus), Medizinische Seife, Seife, Spanische Seife.)

Manufacture: Olive oil and sodium hydroxide are boiled together until saponified—$C_3H_5(C_{18}H_{33}O_2)_3 + 3NaOH = 3NaC_{18}H_{33}O_2$ (hard soap) $+ C_3H_5(OH)_3$. It is a white, whitish solid (in bars), hard, yet easily cut when fresh, or a fine, yellowish-white powder, faint, characteristic odor, free from rancidity, disagreeable, alkaline taste; soluble in water, alcohol, more readily with heat; aqueous solution alkaline. *Impurities:* Water, soap from animal fats, sodium hydroxide, sodium chloride, sodium carbonate, silica, metallic and other alcohol-insoluble substances.

Preps.: 1. *Linimentum Saponis.* Soap Liniment. (Syn., Lin. Sapon., Liquid Opodeldoc, Tinctura Saponis Camphorata, Spiritus Nervinus Camphoratus; Fr. Liniment savonneux camphré; Ger. Linimentum saponato-camphoratum, Opodeldok.)

Manufacture: 6 p. c. Dissolve camphor 4.5 Gm., oil of rosemary 1 cc. in alcohol 70 cc., add soap 6 Gm., water q. s. 100 cc.; agitate until soap dissolved, set in cool place for 24 hours, filter; used externally.

Preps.: 1. *Linimentum Chloroformi,* 70 p. c. 2. *Linimentum Aconiti et Chloroformi, N.F.,* 75 p. c.

2. *Extractum Colocynthidis Compositum,* 15 p. c. 3. *Pilulæ Aloes,* 2 gr. (.13 Gm.). 4. *Pilulæ Asafœtidæ,* 1 gr. (.06 Gm.). 5. *Dentifricium, N.F.,* 5 p. c. 5. *Emplastrum Saponis, N.F.,* 10 p. c. 7. *Lavatio Ori, N.F.,* 6 p. c., + gluside $\frac{1}{5}$ p. c., fuchsin $\frac{1}{5\,0\,0}$, ol. cinnam., ol. menth. pip., āā, $\frac{1}{2}$, ol. caryoph. 1, alcohol 75, water q. s. 100. 8. *Linimentum Saponato-Camphoratum,* Solid Opodeldoc, *N.F.,* sod. carb. monohyd. 1 Gm., acid. stear.

5, camphor 2.5, water 10 cc., ol. thymi .3, ol. rosmar. .6, aq. ammon. 5, alcohol q. s. 100. 9. *Pilulæ Aloes et Asafœtidæ, N.F.*, 1½ gr. (.09 Gm.). 10 *Pilulæ Rhei, N.F.*, 1 gr. (.06 Gm.).

2. *Emplastrum Plumbi Oleatis*, q. s. 3. *Curatio Paraffini, N.F.*, 3 p. c. 4. *Emplastrum Fuscum Camphoratum, N.F.*, 60 p. c. 5. *Linimentum Calaminæ, N.F.*, 50 p. c. 6. *Oleum Phenolatum, N.F.*, 95 p. c. 7. *Unguentum Fuscum, N.F.*, 25 p. c.

Unoff. Preps.: Compound Pill of Soap (Br.), 60 p. c., + opium 20, syrup of glucose 20, dose, gr. 2–4 (.13–.26 Gm.). *Curd Soap* (Br.).

PROPERTIES.—Nutritious, demulcent, emollient, laxative, protection to mucous membrane against acrid or poisonous substances; it increases secretion of bile, peristalsis, and dissolves cholesterin, the chief constituent of gall-stones. Like other oils, it is partly emulsified and saponified in the intestines, its glycerin being set free, and fatty acid combining with free alkalies to form soap, which with the emulsion forms molecular basis of the chyle; it enters the blood through the lacteals, being finally oxidized into carbon dioxide and water. Soap has same properties.

USES.—Gall-stones, cantharides and other poisoning, infantile constipation in enema. Externally—burns, skin inflammations, to protect from air, insect-bites, stings, bruises, sprains, wounds, engorged mammæ, rectal ascarides; facilitates removal of crusts, scales, etc., and introduction of bougies, catheters, pessaries, sounds, specula; to lubricate machinery, in making liniments, plasters, cerates, ointments, etc.

Allied Products:

1. *Olive Gum, Lecca Gum.*—Resinous substance which exudes spontaneously from the trees. 2. *Leaves* and *young bark;* used externally as astringents, antiseptics; internally as tonics in intermittents. 3. *Olive Wood;* has beautiful veins, pleasant odor, capable of fine polish, highly esteemed for backs of brushes, boxes, and in cabinet-work. 4. *Olive Fruit;* as a dessert—for this the unripe fruit is steeped repeatedly in water containing lime and ashes, or solutions of NaOH and NaCl, then bottled in a slightly aromatic, concentrated salt solution; the small French or Provence and the large Spanish olives, "Queen olive," are used for this purpose. Ripe olive, Cal.—purplish-black; oil 50 p. c.; aperient.

55. LOGANIACEÆ. Logania Family.

Lo-ga-ni-a′se-e. L. *Logani-a* + aceæ, after J. Logan, a noted botanist. Shrubs, herbs, trees. Distinguished by poisonous properties; leaves entire, stipulate or raised stipular line; calyx 4–5-cleft, inferior; corolla 4-, 5-, 10-cleft, regular; stamens epipetalous, 4, 5, 10; ovary 2-, 3-, 4-celled, superior; fruit capsule or drupe. Connects Gentianaceæ, Apocynaceæ, Scrophulariaceæ (from which differentiated by having stipules), and Rubiaceæ (which has no free ovary); tropics; nervine, tonic, anthelmintic, poisonous.

Genus: **1. Strychnos.**

NUX VOMICA. NUX VOMICA, *U.S.P.*

Strychnos Nux-vomica, *Linné.* { The dried, ripe seed, yielding not less than 2.5 p. c. of alkaloids.

Habitat. India, Hindustan, E. India islands, Malabar, Ceylon, Java, N. Australia.

Syn. Nux Vom., Dog (Quaker, Bachelor's) Buttons, Vomit (Poison) Nut, Dog Poison, Crow-fig, Ratsbane, False Angustura, Columbrina, Ordeal-root, Nux Metella, Semen Nuces Vomicæ; Fr. Noix vomique; Ger. Semen Strychni, Brechnuss, Krähenaugen.

Strych'nos. L. fr. Gr. *στρύχνος*, night shade, equivalent to L. *solanum*, used anciently for several poisonous plants, but not for the present one.

Nux' Vom'i-ca. L. *nux*, a nut, + *vomere*, to vomit—*i. e.*, excessive doses may vomit, or require vomiting to save life, small doses may allay it.

PLANT.—Small tree, 4.5–9 M. (15–30°) high, trunk short, thick, crooked, branches irregular, bark yellowish-gray, nearly smooth; leaves exstipulate, 5–10 Cm. (2–4′) long, roundish, oval, 3–5-nerved, apex acute, entire, shining; flowers in winter, whitish, funnel-shaped, 8 Mm. ($\frac{1}{3}$′) long, paniculate cymes; fruit shining, globular, 4–5 Cm.

FIG. 309.—*Strychnos Nux-vomica: a*, flowering branch ($\frac{1}{4}$ natural size); *b*, cross-section of fruit; *c*, corolla; also anther, pollen, pistil, ovary, seed, enlarged.

($1\frac{3}{5}$–2′) thick, rind thin, tough, orange-yellow when ripe, filled with poisonous white gelatinous pulp in which 1–5 seed are immersed irregularly. SEED, orbicular, nearly flat, occasionally irregularly bent, 10–30 Mm. ($\frac{2}{5}$–$1\frac{1}{5}$′) broad, 4–5 Mm. ($\frac{1}{6}$–$\frac{1}{5}$′) thick, very hard when dry; grayish, greenish-gray, covered with appressed hairs giving a silky

luster; hilum—a circular scar at the center of one of the flattened sides and connected with micropyle at the edge by a ridge; internally showing a thin, hairy seed-coat and large grayish-white endosperm, at one end of which is embedded a small embryo with 2 ovate 5–7-nerved cotyledons; inodorous; taste intensely, persistently bitter. POWDER, light gray—chiefly thick-walled endosperm cells containing fixed oil globules, few aleurone grains, lignified non-glandular hairs with walls having large pores, few spherical starch grains in tissues of adhering pulp. *Solvents:* 75 p. c. alcohol; boiling water partially. Dose, gr. ½–5 (.03–.3 Gm.).

ADULTERATIONS.—SEED: Rare—as nothing resembles them closely; POWDER: Common—various inert substances (increasing amount of hairs) and olive stones, often 50 p. c. RASPED: "Vegetable ivory" (coroso, negrito), seeds of *Phytel'ephas macrocar'pa* (Australia, used natively for making buttons) and of *Metrox'ylon vitie'se* (so-called Australian "coroso," Fiji Islands, imported into Hamburg for the purpose; odorless, tasteless, bony, revealing decided structural differences under the microscope).

Commercial.—Plant resembles our dogwood and its fruit a small orange. Seed are washed free of pulp and dried in the sun, the best being recognized by light color, ample breadth, thin edge, excessive silkiness, and prominent hilum; they may readily be powdered by breaking into small pieces and drying several days with hot air or carefully applied direct heat; powder should be uniform so as not to retard or prevent thorough exhaustion by menstruum. There are four varieties valued in the order named: 1, *Bombay;* 2, *Cochin* (*Calcutta*); 3, *Ceylon;* 4, *Madras.*

CONSTITUENTS.—Alkaloids 2.5–4–5.3 p. c.: Strychnine .25–2 p. c., Brucine .5–2 p. c., Igasurine (probably impure brucine), all combined with igasuric (strychnic, tannic, caffeo-tannic) acid; Loganin, fixed oil, proteins 11 p. c., yellow coloring matter, gum, sugar 6 p. c., ash 1–3.5 p. c. Dunstan and Short found total alkaloids to vary from 2.74 p. c. in small Madras to 3.9 p. c. in large, silky Bombay seed, of which 30–50 p. c. was strychnine.

Strychnina, Strychnine, $C_{21}H_{22}O_2N_2$, *N.F.*—This alkaloid is found not only in nux vomica, but also in other loganiaceous plants (seeds); it was discovered by Pelletier, 1818, and may be obtained by boiling powdered seed with acidulated (HCl or H_2SO_4) water, thus liberating tannic (igasuric) acid, mucilage, coloring matter, etc., and forming chlorides or sulphates of the alkaloids; concentrate and add milk of lime to decompose alkaloidal salts (forming $CaCl_2$ or $CaSO_4$) and to precipitate strychnine and brucine; wash precipitate, treat it with diluted alcohol to dissolve brucine, or with alcohol or benzene to take out strychnine, thus leaving brucine in the mother-liquor. If diluted alcohol be used for brucine, then by boiling residue with alcohol strychnine is obtained; can purify with animal charcoal and reprecipitate with ammonia. It is in colorless, transparent, prismatic

crystals, white crystalline powder, odorless (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), permanent, soluble in water (6420), boiling water (3100), alcohol (136), boiling alcohol (34), chloroform (5), benzene (180), very slightly in ether; saturated solutions alkaline, levorotatory; forms numerous salts (hydrochloride, nitrate, phosphate, sulphate, etc.). With sulphuric acid containing 1 p. c. of ammonium vanadate—deep violet-blue, changing to deep purple, cherry-red; incinerate 1 Gm.—ash .1 p. c.; solution of .1 Gm. in sulphuric acid 2 cc.—only pale yellow (abs. of readily carbonizable organic substances) until a fragment of potassium dichromate is added—deep blue color, changing to deep violet, purplish-red, cherry-red, orange, yellow. Add .1 Gm. to mixture of equal vols. nitric acid and distilled water—may produce yellow color, but no red or reddish (abs. of brucine). *Impurities:* Brucine, readily carbonizable organic substances; commercial strychnine contains some homo-strychnine, $C_{22}H_{24}O_2N_2$. Dose, gr. $\frac{1}{60}$—$\frac{1}{20}$ (.001–.003 Gm.).

Strychninæ Nitras, Strychnine Nitrate, $C_{21}H_{22}O_2N_2.HNO_3$, *U.S.P.*—(Syn., Strych. Nit; Fr. Azotate (Nitrate) de Strychnine; Ger. Strychninum nitricum, Strychninnitrat, Salpetersaures Strychnin.) Obtained by dissolving strychnine (1) in diluted nitric acid (1,886), or strychnine (5), hot dist. water (50), dilute nitric acid q. s., when neutral evaporate, crystallize. It is in colorless, glistening needles, white, crystalline powder, odorless (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), permanent, soluble in water (45), boiling water (10), alcohol (150), hot alcohol (80), glycerin (50), chloroform (105), insoluble in ether; saturated aqueous solution neutral, slightly acid, levorotatory; contains 84.13 p. c. of the alkaloid. *Tests:* 1. Superimpose in a test-tube an aqueous solution of the salt upon diphenylamine T. S.—a blue color at zone of contact; heated with hydrochloric acid—bright red. 2. Aqueous solution (1 in 100) 20 cc. acidulated with 2 drops diluted nitric acid, + 5 drops of silver nitrate T. S.—no opalescence at once (abs. of chloride); similar solution 20 cc. + 5 drops of barium nitrate T. S.—no immediate turbidity (abs. of sulphate). Should be kept dark in well-closed containers. Dose, gr. $\frac{1}{60}$—$\frac{1}{20}$ (.001–.003 Gm.).

Strychninæ Sulphas, Strychnine Sulphate, $(C_{21}H_{22}O_2N_2)_2.H_2SO_4.5H_2O$, *U.S.P.*—(Syn., Strych. Sulph.; Fr. Sulfate de Strychnine; Ger. Strychninum sulfuricum, Strychninsulfat, Schwefelsaures Strychnin.) Obtained by dissolving strychnine in diluted sulphuric acid, avoiding excess, evaporating filtrate, crystallizing. It is in colorless, white, crystals, white, crystalline powder, odorless, efflorescent (must use great caution in tasting, and then only in very dilute solutions, which are exceedingly bitter—1 in 700,000), soluble in water 35, boiling water (7), alcohol (81), hot alcohol (26), chloroform (220), glycerin, insoluble in ether; saturated aqueous solution (1 in 50) neutral, slightly acid, levorotatory; contains 78.03 p. c. of the alkaloid. *Tests:* 1. Aqueous

solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Dried to constant weight at 100° C. (212° F.)—loses 11 p. c. (all water of crystallization); ash .1 p. c. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{60}$—$\frac{1}{20}$ (.001–.003 Gm.).

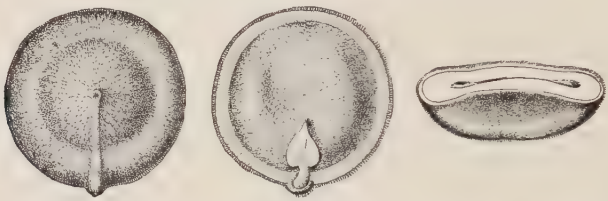


Fig. 310.—Nux vomica: whole seed, cut longitudinally, and cut transversely.

Brucine (Brucina), $C_{23}H_{25}O_4N_2$.—Named after James Bruce (1730–1794), a Scotch traveler, and obtained in extracting strychnine; occurs in rectangular, octahedral crystals, containing $4H_2O$, soluble in water (850), readily in chloroform, alcohol, ammonia, creosote; forms numerous salts, less bitter than strychnine, 12 times weaker, 3 times slower physiologically; by some considered to be strychnine + resin, as it has same action. *Test:* 1. With nitric acid—blood-red color, changing to orange-yellow; now add stannous chloride, sulphurous acid, or any deoxidizing agent—violet-red (this completely bleaches morphine-red). Dose, gr. $\frac{1}{12}$—$\frac{1}{2}$ (.005–.03 Gm.).

Igasurine (Igasuria), fr. Malay, *igasura*, the nux vomica.—Obtained from mother-waters of strychnine and brucine after their precipitation with lime; occurs in white crystals; by some claimed to be a mixture of 9 alkaloids, mostly brucine; others doubt its existence.

Igasuric Acid.—Identical with tannic or caffeo-tannic acid, amorphous, dark green with ferric salts, by hydrolysis yields glucose and caffeic acid.

Loganin, $C_{25}H_{34}O_{14}$.—Bitter glucoside, in white prisms, soluble in water, alcohol; with sulphuric acid—red, then purple, and splits into dextrose and loganetin.

Preparations.—Seed: 1. *Extractum Nucis Vomicæ.* Extract of Nux Vomica. (Syn., Ext. Nuc. Vom., Powdered Extract of Nux Vomica; Fr. Extrait de Noix vomique; Ger. Extractum Strychni, Brechnussextrakt.)

Manufacture: Macerate, percolate 100 Gm. with 75 p. c. alcohol containing acetic acid 1 p. c. until exhausted, reclaim alcohol, concentrate to 20 cc., transfer to flask or separator, add water 15 cc. + purified petroleum benzin 20 cc., shake thoroughly several minutes, decant benzin layer, shake residue again with purified petroleum benzin 10 cc., decant benzin layer, reject benzin solutions. Evaporate fat-free residue on water-bath to dryness, stirring frequently; assay and add q. s. dried starch for extract to contain 15.2–16.8—16 p. c. of the alkaloids. Pulverize, mix thoroughly, pass through fine sieve. Should be

kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.): Preps.: 1. *Pilulæ Aloes et Podophylli Compositæ, N.F.*, $\frac{1}{4}$ gr. (.016 Gm.). 2. *Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, N.F.*, $\frac{1}{4}$ gr. (.016 Gm.).

2. *Tinctura Nucis Vomicæ.* Tincture of Nux Vomica. (Syn., Tr. Nuc. Vom.; Fr. Teinture de Noix-vomique; Ger. Tinctura Strychni, Brechnusstinktur, Krähenaugentinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page, 104, 1st menstruum: 75 p. c. alcohol containing 1 p. c. of acetic acid, 2d menstruum: 75 p. c. alcohol; contains .237–.263—.25 Gm. of alkaloids in each 100 cc. Dose, ♏v–20 (.3–1.3 cc.).

3. *Fluidextractum Nucis Vomicæ, N.F.*, (75 p. c. alcohol), 2.5 Gm. alkaloids in each 100 cc. Dose, ♏j–5 (.06–.3 cc.). Strychnine: 1. *Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, N.F.*, $\frac{1}{125}$ gr. in each ʒj. 2. *Elixir Pepsini, Bismuthi et Strychninæ, N.F.*, $\frac{1}{100}$ gr. in each ʒj. 3. *Liquor Hypophosphitum Compositus, N.F.*, $\frac{1}{250}$ gr. in each ʒj. 4. *Pilulæ Aloini, Strychninæ et Belladonnæ, N.F.*, $\frac{1}{125}$ gr. in each. 5. *Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, N.F.*, $\frac{1}{125}$ gr. in each. 6. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N.F.*, $\frac{1}{20}$ gr. in each. 7. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, N.F.*, $\frac{1}{50}$ gr. in each. 8. *Pilulæ Laxativæ Compositæ, N.F.*, $\frac{1}{125}$ gr. in each. 9. *Syrupus Ferri Quininæ et Strychninæ Phosphatum, N.F.*, $\frac{1}{80}$ gr. in each ʒj. 10. *Syrupus Hypophosphitum Compositus, N.F.*, $\frac{1}{80}$ gr. in each ʒj. Strychnine nitrate: 1. *Elixir Glycerophosphatum Compositum, N.F.*, $\frac{1}{160}$ gr. in each ʒj. 2. *Syrupus Phosphatum cum Quinina et Strychnina, N.F.*, $\frac{1}{125}$ gr. in each ʒj. Strychnine sulphate: 1. *Elixir Cinchonæ Alkaloidorum, Ferri, Bismuthi et Strychninæ, N.F.*, $\frac{1}{100}$ gr. in each ʒj. 2. *Elixir Cinchonæ Alkaloidorum, Ferri et Strychninæ, N.F.*, $\frac{1}{100}$ gr. in each ʒj. 3. *Elixir Ferri, Quininæ et Strychninæ, N.F.*, $\frac{1}{100}$ gr. in each ʒj.

Unoff. Preps.: Abstract (seed), gr. $\frac{1}{4}$–2 (.016–.13 Gm.). Decoction (leaves)—externally in rheumatism. Elixirs, Solutions, Syrups of various salts of strychnine.

Properties.—Motor excitant, spinant, tonic, stomachic, respiratory, cardiac, muscular, and nervous stimulant, antiseptic, poisonous. Strychnine and nux vomica are identical, increasing the vascularity of gastric mucous membrane, secretion of gastric juice, and peristalsis by stimulating the intestinal muscular coat (purgative), stimulates direct the cardiac muscles or the motor ganglia and nerves of special sense; strychnine, full dose, gr. $\frac{1}{10}$ (.006 Gm.), gives dilated pupils, jerky limbs, spasmodic respirations, stiff lower jaw, cerebral tension, shuddering, depression, facial smile or grin. Thebaine (opium) acts similarly. The spasms of tetanus are constant, of strychnine intermittent, with meaningless smile, the modified lockjaw, absence of wound, and rapidly developed symptoms differentiate the two. Strychnine is absorbed rapidly, but eliminated slowly by urinary, salivary, and cutaneous channels.

LOGANIACEÆ

Uses.—Strychnine was used first in paralysis, and now in atonic dyspepsia, gastric catarrh, bowel atony, pregnancy and phthisis vomiting, nervous cough, bronchitis, anemia, paralytic condition, lead palsy, inebriate and diphtherial paralysis, amaurosis from lead, tobacco, alcohol, paralysis of bladder, incontinence of urine, sexual impotence, tetanus, chorea, epilepsy, delirium tremens, spermatorrhea, neuralgia, dysmenorrhea, diarrhea, dysentery, cholera, antidote to chloral hydrate, morphine, physostigmine. A tolerance for it is established quickly, but gr. $\frac{1}{12}$ (.005 Gm.) has killed, while gr. $\frac{1}{2}$–2 (.03–.13 Gm.) as a rule is considered fatal; extract, gr. 3 (.2 Gm.) also have killed.

Poisoning: Strychnine, gr. $\frac{1}{2}$ (.03 Gm.), or more, produces within half an hour difficult breathing, sense of suffocation and impending death, muscular rigidity, stiffness of neck, tonic or persistent convulsions of all extensor muscles, coming on at intervals 3–30 minutes, lasting a few seconds to one or more minutes, these quickly recurring at every noise, touch or peripheral irritation, between convulsions complete relaxation, face dusky and with ghastly grin, angles of mouth drawn back and upward, body curved so as to rest on head and heels, eyeballs prominent, pupils dilated during paroxysm, eyes fixed and open, lips livid, great thirst but unable to drink owing to spasms of jaws, respiration suspended during convulsions, pulse feeble and rapid, involuntary defecation and urination, lockjaw, death in 2–3 hours from asphyxia; mind clear until near the end, when carbon dioxide narcosis (cyanosis), exhaustion and nervous storm set in. Place in horizontal position, in dark room remote from all noise, use evacuants, (stomach-pump, emetics, purgatives), follow with antidotes: tannin dissolved in water, charcoal, potassium permanganate; if ingested relax (convulsions) with chloroform or ether, and give by rectum potassium bromide gr. 60 (4 Gm.) and chloral hydrate, gr. 40 (2.6 Gm.) in starch water; amyl nitrite, (soluble iodides, tobacco, opium, physostigmine, atropine, conium, cannabis). Empty bladder often (catheter), practise artificial respiration.

Incompatibles: Chloral hydrate, potassium bromide, tobacco, chloroform, ether, tannin, bromides, iodides, chlorides.

Synergists: Motor excitants, ergot, ustilago, electricity, cold.

Allied Product:

1. The bark was once (1806–1837) upon the market in England and Holland, being mixed usually with Angustura, and since then has been known as *False Angustura Bark;* it is poisonous, gray, cork patches rust-color, warty, inside brown, fracture smooth, no white striæ (calcium oxalate); contains strychnine, brucine, etc. The wood is used in domestic practice; all portions are medicinal.

Allied Plants:

1. *Strychnos Igna'tii, Ignatia, Saint Ignatius Bean, Ignatia Amara, N.F.*—The dried ripe seed, yielding not less than 2 p. c. of alkaloids nor more than 1 p. c. of foreign organic matter; Philippine Islands. Large climbing shrub; leaves ovate, acute, smooth, flowers white,

tubular, racemes; fruit resembles a pear, pericarp brittle. Seed, 24 imbedded in bitter pulp, 20–30 Mm. ($\frac{4}{5}$–$1\frac{1}{5}'$) long, 15 Mm. ($\frac{3}{5}'$) broad and thick, heavy, hard, horny, angularly ovate, with obtuse angles, several sided, grayish-black, nearly smooth, few hairs; fracture granular and translucent in small fragments, small irregular cavity in center with embryo; nearly inodorous, intensely bitter. Powder, grayish-brown—cells of epidermis and seed-coat, polygonal cells with granular contents from endosperm, few hairs in spreading clusters, embryo tissue of small thin-walled cells; solvent: alcohol; contains more strychnine, but less total alkaloids than nux vomica—strychnine .5–1.5 p. c., brucine .5–1.4 p. c., proteins 10 p. c., ash 4 p. c. Properties, uses and poisoning similar to nux vomica. Dose, gr. $\frac{1}{2}$–3 (.03–.2 Gm.); 1. *Extractum Ignatiæ, Powdered Extract of Ignatia,* 6 p. c. alkaloids, (75 p. c. alcohol), dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.); 2. *Tinctura Ignatiæ,* 10 p. c., $\frac{1}{5}$ p. c. alkaloids (88 p. c. alcohol), dose, ♏v–20 (.3–1.3 cc.). *S. Tieu'te.*—Java; seed resemble nux vomica but smaller, whiter; contain strychnine, brucine; extract used natively for arrow poison. *S. potato'rum,* India; seed subglobular, 12 Mm. ($\frac{1}{2}'$) wide, brownish-gray, not bitter, no strychnine; used natively for clearing muddy water. *S. Colubri'na,* India; yields true *Lignum Colubrinum,* for which nux vomica branches often are substituted. All parts bitter and contain strychnine and brucine; once used as antidote to snake-bites, hence the name. *S. toxif'era (Castelnæa'na), Curara, Curare, Woorara, Urari.*—Brazil, Guiana. Extract of bark (South American arrow poison), blackish, hygroscopic, bitter, friable, 75 p. c. soluble in water; contains curarine, $C_{18}H_{35}N$ (yellowish-brown, bitter alkaloid), resin, fat. Diaphoretic, sedative, irritant; best drug in tetanus. Dose, gr. $\frac{1}{10}$–$\frac{1}{3}$ (.006–.02 Gm.); curarine gr. $\frac{1}{100}$ (.0006 Gm.)—resembles digitalis in action.

Fig. 311.—Ignatia: vertical section.

2. *Gelse'mium semper'virens, Gelsemium, Yellow Jasmine (Root), N.F.*—The dried rhizome and roots with not more than 2 p. c. of foreign organic matter; United States, Va. to Fla. Beautiful woody climber; leaves persistent, evergreen, lanceolate, entire, flowers large, yellow, fragrant, poisonous, corolla funnel-shaped; fruit brown, capsule. Rhizome, cylindrical, in pieces 3–20 Cm. ($1\frac{1}{5}$–8′) long, 3–30 Mm. ($\frac{1}{8}$–$1\frac{1}{5}'$) thick, yellowish-brown, wrinkled, transverse fissures, few stem-scars above, numerous roots beneath; fracture tough, splintery; bark thin; wood radiate, excentric; odor slight; taste bitter. Powder, yellowish—tracheæ, few bast-fibers, lignified tracheids, starch grains, few calcium oxalate monoclinic prisms, groups of stone cells; solvent: diluted alcohol; contains gelsemine, gelseminine, gelsemic acid (beta-methyl-æsculetin) .3–.4 p. c., volatile oil .5 p. c., 2 resins 4 p. c., starch, gum, pectin. Nervine, sedative, mydriatic, antispasmodic, antiperiodic; closely resembles hemlock in action, and somewhat digitalis, aconite, veratrum viride, antimony; rheumatism, neuralgia, intermittent and

yellow fevers, headache, migraine, asthma, chorea, epilepsy, nervous cough, mania. *Poisoning:* Dim vision, projected eyeballs, dropping of

FIG. 312.—*Gelsemium sempervirens: a*, rhizome; *b*, flowering branch; *c*, fruiting branch (¼ natural size); also flower, ovary, fruit, seed, floral diagram, enlarged.

upper eyelid and lower jaw, difficult enunciation, labored breathing, convulsions (strychnine-like), death —evacuants, tannin, cardiac stimulants: ammonia, strychnine, atropine, digitalis; external heat and friction. Dose, gr. 2–10 (.13–.6 Gm.); 1. *Fluidextractum Gelsemii* (80 p. c. alcohol), dose, ♏ij–10 (.13–.6 cc.): Preps.: 1. *Elixir Sodii Salicylatis Compositum*, 1.6 p. c.; 2. *Tinctura Gelsemii*, 10 p. c. (65 p. c. alcohol). Dose, ♏x–60 (.6–4 cc.).

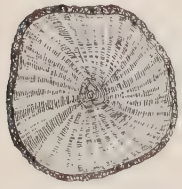


FIG. 313. — *Gelsemium sempervirens:* rhizome, transverse section.

3. *Spige'lia marylan'dica, Spigelia, Pinkroot.* —The dried rhizome and roots with not more than 10 p. c. of stems or other foreign matter, U.S.P. 1820–1910; United States, Maryland, southward. Perennial herb, .3.–6 M. (1–2°) high, purplish; leaves sessile, entire, ovate-lanceolate; flowers large, scarlet red, on one side of stem above the leaves; fruit 2-seeded. Rhizome, horizontal, 1.5–5 Cm.

($\frac{3}{5}$–2′) long, 2–5 Mm. ($\frac{1}{12}$–$\frac{1}{5}$′) thick, dark brown, cup-shaped scars above, numerous roots beneath; fracture short, brittle, 3 zones—pith, wood, bark; odor slightly aromatic; taste bitter, pungent. Powder, grayish-brown—starch grains, lignified tracheæ, tracheids, bast-fibers, reddish-brown epidermal cells; solvents: diluted alcohol, boiling water; contains bitter principle (?), spigeline, volatile oil, resins, tannin, wax, fat, gum, ash 8–10 p. c. Anthelmintic, toxic, mydriatic; large doses narcotic poison; to destroy round worms, usually associated with senna or calomel, or followed by Epsom salt. *Poisoning:* Vertigo, dilated pupils, dry throat, convulsions, delirium—diffusible stimulants: ammonia, brandy, amyl nitrite, atropine, digitalis, Dose, ℥ss–2 (2–8 Gm.); children gr. 10–20 (.6–1.3 Gm.); Fluidextract (diluted alcohol); Compound Infusion (Worm Tea), 15 Gm. + senna 10, fennel 10, manna 30, water q. s. 500 cc., ℥ij–5 (60–150 cc.). *S. anthel'mia, Demerara Pink Root, Worm Grass.*—W. Indies. Used for a long time by the native Indians as a vermifuge and narcotic; fresh root has nauseous odor, is bitter, acrid, and kills cattle. *Phlox' caroli'na, Carolina* or *Georgia Pink.*—This has a knotty and lighter colored rhizome with a central pith; it is also an anthelmintic, as is *P. glaber'rima.*

Fig. 314.—*Spigelia marylandica.*

56. GENTIANACEÆ. Gentian Family.

Jen-shia-na'se-e. L. *Gentian-a* + aceæ, fr. Gr. γεντιανή—*i. e.*, after Gentius, King of Illyria, who first discovered and experienced its virtues. Herbs, shrubs. Distinguished by being smooth, with bitter principles; leaves exstipulate, entire, glabrous, sessile; flowers regular, 5's, sometimes 4, 6, 8, 10; ovary 1-celled; fruit capsule, 1–2-celled, 2-valved; seeds many; universal; tonic, febrifuge, stomachic.

Genus: **1. Gentiana.**

GENTIANA. GENTIAN, *U.S.P.*

Gentiana lutea, *Linné.* { The dried rhizome and roots, yielding not less than 30 p. c. of water-soluble extractive.

Habitat. C. and S. Europe (France, Austria, Germany, Switzerland, Portugal, England); mountainous districts.

Syn. Yellow Gentian Root, Pale Gentian, Bitter Root, Bitterwort, Felwort, Radix Gentianæ Rubræ, Luteæ or Majoris; Br. Gentianæ Radix; Fr. Gentiane, Racine de Gentiane (de Gentiane jaune); Ger. Radix Gentianæ, Enzianwurzel, Bitterwurzel, Rother (Gelber) Enzian.

Gen-ti-a'na. L. see etymology, page 487, of Gentianaceæ.

Lu'te-a. L. *luteus*, golden-yellow—*i. e.*, the flowers.

PLANT.—Large perennial herb; stem thick, hollow above, .6–1.3 M. (2–4°) high, yellowish-green, underground portion .6–1 M. (2–3°) long, branched; leaves entire, 5–7-nerved, 15–30 Cm. (6–12′) long, ovate, glabrous, yellowish-green; flowers June–Aug., numerous, cymes of 20 or more; corolla 5 Cm. (2′) long, orange-yellow, spotted, 6 segments; fruit 1-celled, ovate capsule, 3 Cm. ($1\frac{1}{5}$′) long, many winged-seed. RHIZOME (root), in subcylindrical, sometimes branching pieces, of variable length, 5–40 Mm. ($\frac{1}{5}$–$1\frac{3}{5}$′) thick, yellowish-brown, rhizome annulate, roots longitudinally wrinkled; fracture short and uneven when dry, tough and flexible when damp; internally yellowish-brown, bark .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, separated from a spongy wood by a dark brown cambium zone; odor strong, characteristic; taste slightly sweetish, strongly and persistently bitter. POWDER, yellowish-brown — parenchymatous cells with fragments of scalariform or reticulate tracheæ, few or no starch grains and calcium oxalate crystals; no stone cells, bast- or wood-fibers. *Solvents:* water; diluted alcohol. Dose, gr. 5–30 (.3–2 Gm.).

FIG. 315.—*Gentiana lutea.*

ADULTERATIONS.—RHIZOME: Through carelessness—rhizomes, roots of allied species, especially *G. asclepia'dea* (stone cells and prosenchymatous tissue); aconite, belladonna, white hellebore, orris (none yellow internally), *Rumex alpi'nus* (odor and taste distinct—bitter, astringent without gentian aroma); POWDER: Ground pine-wood, almond shells, olive stones, sack and rope fibers, etc.

Commercial.—Plant, remarkable for beauty and size, was used by the Greeks and Arabians, and grows in the Alps, Apennines, Pyrenees, Jura, Vosges, 900–1200 M. (3000–4000°) elevation, along with vera-

trum album, the leaves of both closely resembling. Rhizome and roots are collected usually when in flower, washed, dried, and exported from Germany, France (Marseilles)—our chief supply. Austria imposes a fine for collecting any less than 2 Cm. ($\frac{4}{5}$′) thick at the crown—product of plants 3 years old, which insures propagation through having produced seed.

Constituents.—Gentiopicrin, Gentiin, gentiogenin, $C_{10}H_{10}O_4$, gentienin, $C_{14}H_{10}O_5$, gentianose, $C_{16}H_{66}O_{31}$ (uncrystallizable sugar) 14 p. c., resin, gum, pectin, fixed oil 6 p. c., yellow coloring matter, identical with quercitrin, ash 6 p. c.

Gentiopicrin, $C_{16}H_{20}O_9$.—Bitter glucoside, upon which activity depends, obtained by diluting alcoholic extract with alcohol, extracting with equal weight of warm hydrous ether, evaporating to get crystals that contain 1 p. c. gentiin, which can be removed by recrystallizing from acetic ether + 2 p. c. of water; by hydrolysis yields glucose and gentiogenin (white crystals).

Gentiin, $C_{25}H_{28}O_{14}$.—Crystallizes from 60 p. c. hot alcohol in yellow needles, insoluble in water, blackish-green with ferric chloride, heated with 4 p. c. of sulphuric acid splits into glucose, xylose and gentienin.

Fig. 316.—Gentian rhizome, longitudinally sliced, about one-half natural size.

Preparations.—1. *Tinctura Gentianæ Composita.* Compound Tincture of Gentian. (Syn., Tr. Gentian Co.; Fr. Teinture de Gentiane composée; Ger. Zusammengesetzte Enziantinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104—using gentian 10 Gm,. bitter orange peel 4 Gm., cardamom seed 1 Gm., packing moderately; 1st menstruum: glycerin 10 cc., alcohol 50, water 40, finishing with diluted alcohol q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

2. *Extractum Gentianæ, N.F.*—yield 30 p. c. (water). Dose, gr. 2–10 (.13–.6 Gm.).

Preps.: 1. *Pilulæ Antiperiodicæ, N.F.*, q. s. 2. *Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, N.F.*, q. s.

3. *Fluidextractum Gentianæ, N.F.* (diluted alcohol). Dose, ♏v–30 (.3–2 cc.).

Preps: 1. *Elixir Gentianæ, N.F.*, 3.5 p. c. Dose, ʒj–2 (4–8 cc.).

Preps.: 1. *Elixir Gentianæ et Ferri, N.F.*, 90 p. c. 2. *Elixir Gentianæ et Ferri Phosphatis, N.F.*, 95 p. c. Dose, each, ʒj–2 (4–8 cc.).

2. *Elixir Gentianæ Glycerinatum, N.F.*, 1 p. c. Dose, ʒj–2 (4–8 cc.).

GENTIANACEÆ

4. *Infusum Gentianæ Compositum, N.F.*, 3 p. c. Dose, ℥ij–4 (8–15 cc.). 5. *Tinctura Rhei et Gentianæ, N.F.*, $1\frac{3}{4}$ p. c. 6. *Tinctura Amara, Bitter Stomach Drops, N.F.*, 6 p. c. + centaury 6, bitter orange peel 6, zedoary 2 (67 p. c. alcohol q. s.). Dose, ℥ss–1 (2–4 cc.). 7. *Tinctura Antiperiodica, N.F.*, $\frac{1}{5}$ p. c.

Properties.—Tonic, bitter, increases appetite, digestion (action local); large doses oppress stomach, irritate bowels, nauseate, and cause vomiting.

Uses.—Dyspepsia, atonic gout, amenorrhea, hysteria, scrofula, intermittents. *G. Elliot'tii (Catesbæ'i), Elliott's Gentian.*—The root, U.S.P. 1820–1870; United States, grassy swamps. Perennial herb, 20–60 Cm. (8–24′) high, rough; leaves 2.5–5 Cm. (1–2′) long, lanceolate, serrate; flowers Oct., blue, 4 Cm. ($1\frac{3}{5}$′) long; corolla 10 segments, 5 inner fringed; root resembles the official; constituents and uses similar; in infusion, wine, tincture. *G. purpu'rea* (purplish flowers), *G. pannon'ica* (dark purple flowers), and *G. puncta'ta* (yellow, purple-dotted flowers); all grow along with official, and collected for it.

Allied Plants:

1. *Erythræ'a Centau'rium, Centaurium, Centaury, N.F.*—The dried flowering herb with not more than 3 p. c. of foreign organic matter; C. and S. Europe. Plant glabrous, 15–50 Cm. (6–20′) high, branched, leaves opposite, entire, sessile, ovate, obovate; flowers, cyme, rose-colored, calyx 5-parted, stamens 5, bright yellow, pistil 2, carpelled; odor faint, characteristic; taste persistently bitter. Powder, brownish-yellow—wood-fibers, wood parenchyma and tracheæ, calcium oxalate rosettes or prisms, non-glandular hairs, few stomata, chlorophyll, tissue of petals and calyx with papillated cells, abundant pollen grains, small stone cells of seed-coat, pith and cortical parenchyma; solvent: diluted alcohol; contains erythrocentaurin (bitter glucoside), erytaurin, waxy and saline substances. Tonic, bitter; dyspepsia, similar to gentian and chirata. Dose, ℥ss–1 (2–4 Gm.); 1. *Tinctura Amara*, 6 p. c.

2. *Swer'tia Chiray'ita, Chirata, N.F.*—The dried plant with not more than 3 p. c. of foreign organic matter; N. India—mountains. Annual plant, 1 M. (3°) high, cylindrical above, quadrangular below, smooth, yellowish-brown, branched; wood yellowish—thin, enclosing large yellowish, easily separable pith; root simple, 7 Mm. ($\frac{1}{4}$′) thick near the crown; leaves opposite, sessile, ovate-lanceolate, entire; flowers small, panicled, 4-lobed calyx and corolla; fruit capsule, ovoid, many-seeded; odor slight; taste intensely bitter. Powder, yellowish-brown—numerous tracheæ, lignified fibers, abundant pith parenchyma cells with lignified walls, epidermis with stomata, seed, fragments of seed-coat, pollen grains, cells with brown resin and tannin masses; solvents: diluted alcohol, water partially; contains ophelic acid, chiratin, ash 6 p. c. (K, Ca, Mg, carbonates and phosphates). Tonic, febrifuge, stomachic, laxative, antispasmodic, hepatic, stimulant, large doses nauseate; indigestion, constipation, chronic bronchitis, similar to gentian and calumbo. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum*

Chiratæ (diluted alcohol), dose, ♏xv–30 (1–2 cc.); Tincture 10 p. c. (67 p. c. alcohol), ʒss–1 (2–4 cc.). *S. angustifo'lia* and *S. pulchel'la* have entire square stems, pith thin or wanting; less bitter but used to adulterate the preceding.

3. *Sabba'tia angula'ris, American Centaury.*—The herb, U.S.P. 1820–1870; United States. Plant .3–.6 M. (1–2°) high, stem branched above, square, smooth; leaves ovate, 2.5 Cm. (1′) long, heart-shaped; flowers deep rose, central star greenish, wheel-shaped, 5-parted, bitter; contains bitter principle, fat, erythrocentaurin. Used as tonic, febrifuge, diaphoretic, rheumatism, sore throat, fevers. Dose, gr. 15–60 (1–4 Gm.). *S. Elliot'tii, Quinine Flower; S. campes'tris,* and *Erythræ'a Centau'rium, European Centaury;* all may be used similarly.

4. *Frase'ra carolinen'sis* (*Walte'ri*), *American Colombo.* — The root, U.S.P. 1820–1870; United States. Perennial herb, 1–2.5 M. (3–8°) high, dark purple stem 2.5–5 Cm. (1–2′) thick; leaves in whorls 4–6, entire, spatulate; flowers July, yellow, purple-dotted, large; root fusiform, fleshy, yellow. Usually in segments 2.5 Cm. (1′) thick, annulate, orange-brown; odor gentian-like; taste sweet, bitter; constituents and uses like gentian. Dose, gr. 15–30 (1–2 Gm.).

Fig. 317.—*Menyanthes trifoliata.*

5. *Menyan'thes trifolia'ta, Buckbean, Bogbean, Water Shamrock.*—The root (rhizome), U.S.P. 1820–1830; dried leaves; United States. Perennial herb, 2.5–3.7 M. (8–12°) high; rhizome 1–2.5 Cm. (⅖–1′) thick, slightly longer, branching, black; leaves on petioles, 10–15 Cm. (4–6′) long, ternate, leaflets sessile, 5–8 Cm. (2–3′) long, obtuse, obovate, entire or crenate, smooth, pale green, inodorous, bitter; contains menyanthin (glucoside, yields menyanthol), mucilage, albumin, sucrose, fat, ash 10 p. c. Tonic, febrifuge, emmenagogue, antiscorbutic, vermifuge; large doses emetic, purgative; rheumatism, scrofula, scurvy, dropsy, intermittents, jaundice, dyspepsia, worms. Dose, gr. 15–30 (1–2 Gm.).

57. APOCYNACEÆ. Dogbane Family.

A-pos-i-na'se-e. L. *Apocyn-um* + aceæ, fr. Gr. ἀπό, from, away, + κύων, a dog—*i. e.*, drives away or kills dogs, hence dogbane. Trees, shrubs. Distinguished by being milky, acrid, poisonous; leaves exstipulate, entire; calyx and corolla 5-lobed; from Ascelpiadaceæ by stamens being free from style and stigma (insertion on the corolla), granular pollen, filaments distinct; ovary 2, usually separate; fruit 2 follicles or drupes; tropics; purgative, tonic, febrifuge, poisonous.

Genus: **1. Strophanthus.**

STROPHANTHUS. STROPHANTHUS, *U.S.P.*

Strophanthus { **Kombé,** *Oliver,* / **hispidus,** *De Candolle.* } The dried, ripe seed, deprived of the awns, and assayed biologically (frog).

Habitat. Tropical Africa (Kombé, Guinea, Senegambia), Asia, Philippines.
Syn. Strophanth.; Br. Strophanthi Semina; Fr. Strophanthus, Semence de Strophanthe; Ger. Semen Strophanthi, Strophanthussamen.
Stro-phan'thus. L. fr. Gr. στροφή, turning, to turn, twist, + ἄνθος, a flower—*i. e.*, from the twisted and tailed lobes of the corolla.
Kom-be'. Native place of plant, in Gaboon district, Africa.
His'pi-dus. L. hairy, bristly—*i. e.*, seed covered with long, coarse hairs.

PLANTS.—Woody climbers, stem, several inches thick, emits milky juice; leaves rough; flowers Oct.–Nov., cream-color, yellow at base, purple-spotted above, cymes; corolla gamopetalous, lobes extended in narrow, tail-like ends, 22.5–30 Cm. (9–12′) long; fruit June, pair of follicles, 20–37.5 Cm. (8–15′) long, 2.5 Cm. (1′) thick, acuminate, each containing about 200 long-awned seed. SEED (*S. Kombé*); oblong-lanceolate, flattened and obtusely edged, 8–25 Mm. ($\frac{1}{3}$–1′) long, 2.5–5 Mm. ($\frac{1}{10}$–$\frac{1}{5}$′) broad, .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, raphe ridge from near center on one side to apex, light brown with greenish tinge; silky, lustrous owing to dense coat of closely appressed hairs; fractured surface whitish, oily, taste very bitter; (*S. hispidus*): light to dark brown, otherwise resembling the preceding except smaller and with fewer and smaller hairs. POWDER, grayish-brown—epidermal cells, slightly lignified hairs, fragments of endosperm and cotyledons with fixed oil, aleurone grains, starch grains, .004–.008 Mm. ($\frac{1}{6250}$–$\frac{1}{3125}$′) broad, calcium oxalate prismatic crystals absent in seed-coat (abs. of *S. Courmonti*). *Solvents:* 65 p. c. alcohol; boiling water partially. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.).

FIG. 318.—*Strophanthus Kombé:* flowering branch; *a*, *a*, *a*, budding branches.

ADULTERATIONS.—White, woolly strophanthus, *S. Nicholson'ii* (*as'per*), hairs white, long, producing shaggy, stout appearance; *S. gra'tus*, seed brown, without hairs; *S. Courmon'ti* seed small, brownish, ventral ridge obscure, with calcium oxalate crystals; *Kickx'ia africa'na*, seed with both ends acuminate, terete, hairless.

Commercial.—Plants abound in the forests between the coasts and center of the continent, reaching the highest trees, and hanging in

festoons and coils upon the ground. Fruit is collected by the natives who peel off husks (epicarp, mesocarp), preserve, and dry the smooth, yellowish-brown, more leathery inner covering (endocarp) enclosing the seed, and as such consists of seed 37 p. c., endocarp (pod) 37 p. c., hairs 25 p. c.; the lighter in color the pappus, the higher in grade the contained seed; occurs on the market in pods and as clean seed.

CONSTITUENTS.—Strophanthin 1–3 p. c., choline, trigonelline, fixed oil 25–30 p. c., starch, proteins, pseudo-strophanthinin (?), strophanthic acid (?), ash 4–5 p. c.

Strophanthinum, Strophanthin, $C_{40}H_{66}O_{19}$, *U.S.P.*—(Syn., Fr. Strophantine, Inéine; Ger. Strophanthin.) This glucoside or mixture of

FIG. 319.—*Strophanthus Kombé:* capsule, one-half natural size.

glucosides is obtained by exhausting seed with ether or petroleum benzin (removing fat), then extracting with 70 p. c. alcohol, reclaiming latter, dissolving residue in water, filtering; add tannin, wash precipitate, mix with litharge, dry, exhaust with alcohol, precipitate with ether; heated with diluted hydrochloric acid becomes hydrolyzed, yielding strophanthidin, $C_{27}H_{38}O_7 + 2H_2O$, which precipitates, and strophanthobiose-methyl-ether, $C_{12}H_{21}O_{10}CH_3$, remaining in solution. It is a white, yellowish powder, containing varying amounts of water, which it does not lose entirely without decomposition, permanent (must use great caution in tasting and then only in very dilute solutions), soluble in water, diluted alcohol, less so in dehydrated alcohol, nearly

insoluble in chloroform, ether, benzene; solutions neutral, dextrorotatory. *Tests:* 1. With sulphuric acid—emerald-green color, changing to brown; incinerate .1 Gm.—ash negligible. 2. Aqueous solution (1 in 50) with trace of ferric chloride T. S., and a few cc. of sulphuric acid—red-brown precipitate, turning dark green in 1–2 hours. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{300}$—$\frac{1}{120}$ (.0002–.0005 Gm.).

Fig. 320.—Strophanthus seed with comose awn.

Fixed Oil.—Brownish-green, non-drying, heavy odor, sp. gr. 0.925, contains volatile oil, phytosterin, formic acid, oleates, stearates, arachinates; may be the irritating ingredient.

Preparations.—1. *Tinctura Strophanthi.* Tincture of Strophanthus. (Syn., Tr. Strophanth.; Fr. Teinture (de Semences) de Strophanthus; Ger. Strophanthus (samen) tinktur.)

Manufacture: 10 p. c. Percolate slowly 10 Gm. with purified petroleum benzin until no greasy stain left; unpack and expose contents to air until dry and benzin odor disappeared, then proceed similar to Tinctura Veratri Viridis, page 104; menstruum: alcohol—moistening and macerating for 48 hours (instead of 24 hours) before starting percolation. Adjust the volume of finished tincture to conform to its biological standard. Dose, ♏j-10 (.06–.6 cc.).

Unoff. Preps.: Decoction, 1 p. c., ♏x–60 (.6–4 cc.). Extract (Br.), 50 p. c., gr. ¼–1 (.016–.06 Gm.). *Test:* 1. The tincture or extract + ferric chloride T. S. + sulphuric acid, gives brown precipitate changing to green after 1 hour, and so remains 3–4 hours.

PROPERTIES.—Similar to digitalis; heart stimulant, diuretic. Acts directly on muscular tissue of the heart, increasing the contractile power; small doses stimulate contractions, strengthen the force and lower the rate of heart-beats, thus prolonging diastole without altering the duration of the systole, making regular an irregular heart; large doses paralyze the heart, leaving cardiac muscle rigid. It is a better diuretic and a more powerful cardiac stimulant than digitalis, the effect coming on much more quickly, yet being less permanent; reduces pulse and temperature, but is not cumulative, nor does it occasion any gastro-intestinal derangement other than increased peristalsis (sometimes diarrhea); the increased cardiac action stimulates renal circulation, thereby causing the diuretic action.

USES.—Cardiac dyspnea, chronic Bright's, valvular heart lesions, palpitation, weak heart, pulmonary edema from pneumonia, cardiac dropsy, endocarditis, hysteria, chlorosis, renal calculi, asthma, exophthalmic goiter. The effect is felt within half an hour, lasting 4–8 hours, reducing pulse 10–30 beats, at the same time increasing force and volume. The natives make of it an arrow poison (*kombé*), which is an extract, to be applied as a coating over several inches of the pointed end. Game, when wounded, soon becomes exhausted, but flesh is not injured by the poison.

Poisoning, Incompatibles, Synergists: Same as for digitalis. *S. dichot'omus, False Strophanthus Seed;* these are chestnut-brown and less densely covered with hair, otherwise resemble the official.

Allied Plants:

1. *Apo'cynum cannab'inum, Apocynum, Canadian Hemp, Dogbane, N.F.*—The dried rhizome and roots with not more than 5 p. c. of stems or other foreign organic matter; United States, Canada to Florida. Perennial milky-juiced herb, 1–2 M. (3–6°) high, glabrous, branched; leaves opposite, entire, mucronate; flowers, cymes, greenish-white; fruit acute follicle, 20 Cm. (8′) long, 4 Mm. (⅙′) thick. Rhizome, cylindrical, branched, varying length, 3–10 Mm. (⅛–⅖′) thick, grayish-brown, wrinkled, occasional transverse fissures with vertical sides through bark; fracture short; bark (50–65 p. c. of root) brownish, 1.5–3 Mm. (1/18–⅛′) thick—containing laticiferous ducts and bitterness; wood radiate with large tracheæ; pith small, in rhizome pieces only; almost

inodorous; taste starchy, bitter, acrid. Powder, light brown—numerous starch grains, some altered, swollen and with central cleft, lignified

FIG. 321.—*Apocynum cannabinum.*

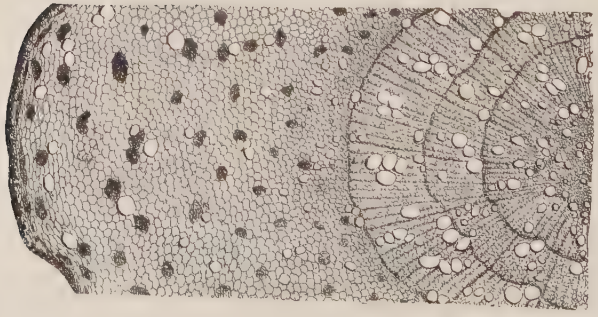


FIG. 322.—*Apocynum cannabinum:* root, transverse section, magnified 25 diam.

wood-fibers, tracheæ, few cork cells with reddish-brown walls, few latex cells, few or no stone cells; solvents: 60 p. c. alcohol, boiling water

partially; contains cynotoxin, tannin, resin, starch, ash 5 p. c. Diuretic, diaphoretic, expectorant, antiperiodic, alterative, cardiac stimulant (similar to digitalis); emetic; cardiac and renal dropsy, intermittents, dyspepsia. Dose, gr. 2–5 (.13–.3 Gm.); emetic, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Apocyni* (60 p. c. alcohol), dose, ♏ij–5—30 (.13–.3 —2 cc.). Extract (aqueous), Infusion, 5 p. c., Tincture, 10 p. c. *A. androsæmifo'lium, Spreading Dogbane.*—The rhizome (root), U.S.P. 1830–1870; N. America. Grows associated with the preceding, having stem more spreading, leaves broader, rhizome thinner, tougher, with central pith; bark thinner with layer of stone cells; flowers pinkish; contains (supposedly) about the same as *A. cannabinum*, causing it to be used for similar purposes, but, as a fact, it produces quite different effects.

Fig. 323.—Aspidosperma (one-half natural size).

2. *Aspidosper'ma Quebra'cho-blan'co, Aspidosperma, Quebracho Bark.* —The dried bark with not more than 2 p. c. of wood or other foreign matter, U.S.P. 1890–1910; S. America, Argentine Republic, Chile. Evergreen tree, 25–30 M. (80–100°) high, drooping branches; wood brownish; leaves lanceolate, small, coriaceous, rigid, glaucous; flowers campanulate, yellowish, 5's; fruit dehiscent capsule, pericarp thick, woody. Bark, in irregular pieces, 5–14 Cm. (2–6′) long, 10–35 Mm. ($\frac{2}{5}$–1$\frac{2}{5}$″) thick, 2-layers—outer corky, 3–25 Mm. ($\frac{1}{8}$–1″) thick, reddish-brown, deeply furrowed, frequently reticulate with longitudinal and shallow transverse fissures; outer surface of bark (after removing cork) reddish-brown, rough, inner surface yellowish-brown, sometimes with adhering wood, striate, porous; fracture short, fibrous, revealing 2 well-defined strata of near equal thickness marked with dots, stone cells and striæ; nearly inodorous; taste bitter, slightly aromatic. Powder, reddish-brown—bast-fibers, crystal-fibers, stone cells, cork cells, starch grains; solvent: diluted alcohol; contains aspidospermine, aspidosper-

matine, aspidosamine (amorphous), quebrachine, quebrachimine, hypoquebrachine (amorphous), quebrachit (sugar), tannin 3–4 p. c. Cardiac and respiratory stimulant, slows and deepens breathing, antispasmodic, antiperiodic—poisonous, death from asphyxia, solutions protective to wounds; cardiac and asthmatic dyspnea, phthisis, asthma from bronchitis or chronic pneumonia, shortness of breath. Dose, gr. 15–30 (1–2 Gm.); Fluidextract, Extract, Tincture, 20 p. c., Wine. *Quebracho Colorado* (*Loxopteryg'ium Lorent'zii—Red Quebracho*).—S. America, Bark checkered, wood red, light brown (Colorado); contains tannin 20 p. c., loxopterygine; resinous exudation of bark resembles kino; resembles aspidosperma but deeper color, largely used in tanning. *Quebracho flo'ja* (*Iodi'na rhombifo'lia*), S. America, and *Copalchi Bark* (*Croton ni'vens*), Mexico. All three collected and sold as aspidosperma.

3. *Ascle'pias tubero'sa, Asclepias, Pleurisy Root, N.F.*—Asclepiadaceæ. The dried root with not more than 5 p. c. of foreign organic matter; United States, Canada. Perennial plant with numerous stems .6–1 M. (2–3°) high, hairy, green or reddish, differing from other asclepiades in not emitting milky juice; flowers beautiful orange-red. Root, irregularly fusiform, 10–20 Cm. (4–8′) long, .5–5 Cm. ($\frac{1}{5}$–2′) thick, occasionally branched, usually in pieces; orange-brown, annulate above, numerous intersecting grooves; bark thin; fracture tough, granular and white, yellowish wood bundles and medullary rays; odor slight; taste bitterish, disagreeable, acrid. Powder, yellowish-brown—many starch grains, calcium oxalate rosettes, abundant parenchyma cells, many filled with starch grains; stone cells, tracheæ, bordered pores, few fibers; solvent: diluted alcohol; contains asclepiadin—the active glucoside, volatile oil, 2 resins, mucilage, starch, tannin, ash 9 p. c. Diaphoretic, expectorant, carminative, sudorific, anodyne, irritant, large doses emetic, cathartic; pleurisy (hence name), pneumonia, consumption, rheumatism of chest, colic, dyspepsia, asthma, scrofula, ulcers, wounds. Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Asclepiadis* (diluted alcohol), dose, ʒss–1 (2–4 cc.).

4. *A. incarna'ta, Flesh-colored Asclepias, Swamp Milkweed.*—The root (rhizome), U.S.P. 1820–1830, 1840–1850, 1870; Canada, United States. Perennial herb, smooth or pubescent, .6–1 M. (2–3°) high, with 2 downy lines above; very leafy; leaves lanceolate, cordate base, 10–17.5 Cm. (4–7′) long, 2.5–5 Cm. (1–2′) wide; flowers rose-purple, sweet-scented; root 2.5 Cm. (1′) long, knotty, oblong, brownish, bark thin, central pith, sweet, then acrid bitter, emits milky juice when wounded; contains volatile oil, 2 acrid resins, asclepiadin. Alterative, emetic, cathartic, diuretic, like *Asclepias tuberosa;* decoction, infusion, tincture. Dose, gr. 15–40 (1–2.6 Gm.).

5. *A. syri'aca* (*Cornu'ti*), *Common Milkweed, Silkweed.*—The root (rhizome), U.S.P. 1820–1850, 1870; United States. Herb 1–1.5 M. (3–5°) high, stout, pubescent, finely soft; leaves oblong, 10–20 Cm. (4–8′) long, downy beneath; flowers large, purplish-white, sweet-

scented, hoods ovate with a tooth each side of stout, claw-like horn; fruit prickly pods containing much silky seed-down; root 2.5–15 Cm. (1–6′) long, 6–12 Mm. ($\frac{1}{4}$–$\frac{1}{2}$′) thick, in sections, wrinkled, knotty, brownish; bark tough, thick, with laticiferous vessels, wood-wedges yellow, bitter, nauseous; contains asclepion (tasteless), bitter, crystalline principle, caoutchouc (6 p. c. of milk-juice), resin, tannin, starch. Used like preceding, also to coat over wounds, ulcers, etc., to promote cicatrization. Dose, gr. 15–40 (1–2.6 Gm.). *A. curassav'ica, Bastard Ipecacuanha*, C. and S. America; flowers bright red; the glossy seed-hairs, called vegetable silk, firmer than the preceding; contains asclepiadin; used natively as we do *Asclepias tuberosa.*

6. *Marsde'nia (Gonol'obus) Conduran'go, Condurango, N.F.*—The dried bark with not more than 2 p. c. of wood or other foreign organic matter; Ecuador. Climbing vine, 3–9 M. (10–30°) high. Bark (stem) in quills, curved pieces, 4–13.5 Cm. ($1\frac{3}{5}$–$5\frac{2}{5}$′) long, 1–6 Mm. ($\frac{1}{25}$–$\frac{1}{4}$′) thick, grayish-brown, nearly smooth, numerous lenticels, or scaly and rough, occasionally with whitish lichens; inner surface grayish-white, striate; fracture short-fibrous, granular; odor slightly aromatic (fresh); taste bitter, aromatic. Powder, yellowish-brown—stone cells, parenchyma with calcium oxalate crystals, rosettes, prisms and starch grains; bast-fibers non-lignified, latex tubes with a granular substance, grayish-yellow cork; solvent: diluted alcohol; contains condurangin (bitter glucoside), alkaloid (strychnine-like action), conduransterin, resin, starch, sugar, tannin 12.6 p. c., crystalline acid, wax, ash 12 p. c. Alterative, stomachic, tonic; cancer, syphilis, rheumatism; may occasion nausea, vomiting, convulsions, paralysis. Dose, ʒss–1 (2 4 Gm.); 1. *Fluidextractum Condurango* (diluted alcohol), dose, ʒss–1 (2–4 cc.). Infusion, Wine.

58. CONVOLVULACEÆ. Morning-glory Family.

Kon-vol-vu-la'se-e. L. *Convolvul-us* + aceæ, fr. *convolvere*, to roll together, entwine—*i. e.*, referring to stem's twining habit. Herbs, shrubs. Distinguished by twining or trailing habit, roots, containing acrid, milky, purgative juice; leaves exstipulate, sometimes parasitic and leafless; calyx 5, imbricate, inferior; corolla regular, 5-plaited or -lobed; ovary 2–4-celled; ovules 2 in each cell; fruit capsule, 2–4-celled. Allied to Solanaceæ and Scrophulariaceæ, but differing in habit, alternate leaves, and large solitary seeds, with crumpled embryo; tropics, temperate climates; purgative (glucosides in juices); some roots edible (starch, sugar).

Genera: **1. Exogonium. 2. Ipomœa.**

JALAPA. JALAP, *U.S.P.*

Exogonium Jalapa, *(Nuttall et Coxe) Baillon.* { The dried tuberous root, yielding not less than 7 p. c. of the total resins.

CONVOLVULACEÆ

Habitat. E. Mexico, in damp, rich, shady woods; cultivated in India.

Syn. True Jalap, Vera Crux Jalap, Radix Jalapæ; Fr. Jalap—tubéreux—officinal; Ger. Tubera Jalapæ, Jalapenwurzel, Jalapenknollen, Jalape.

Ex-o-go'ni-um. L. fr. Gr. ἔξω, outside, + γόνος, offspring—*i. e.*, parts of generation (stamens, pistil) exserted—extended above corolla.

Jal'a-pa. L. named after *Jalapa* or *Xalapa*, a city in Mexico, whence imported.

Jal'ap. Formerly *jal'op*, English abbreviation from *Jalapa*.

PLANT.—Perennial twining herb; stems numerous, slender, twisted, furrowed, smooth, purplish, 3.6–6 M. (12–20°) long, twining around

FIG. 324.—*Exogonium Jalapa.*

neighboring objects; leaves exstipulate, 10–12.5 Cm. (4–5′) long, cordate, entire, smooth, pointed, under side paler, prominently veined, on long petioles; flowers Sept.–Nov., purple, salver-shaped, tube 5 Cm. (2′) long, limb 5–7.5 Cm. (2–3′) wide, in 3-flowered cymes, stamens exserted (*exogonium*). ROOT, fusiform, irregularly ovoid, pyriform,

4–15 Cm. ($1\frac{3}{5}$–6′) long, 1–10 Cm. ($\frac{2}{5}$–4′) thick, often incised or cut into pieces; dark brown, longitudinally wrinkled or furrowed, numerous lenticels; hard, compact; not fibrous, internally grayish-brown, with distinct brown cambium line; odor slight, distinctive, smoky; taste somewhat sweet, acrid. POWDER, light brown—numerous starch grains, .003–.035 Mm. ($\frac{1}{8325}$–$\frac{1}{725}$′) broad, concentric or excentric lamellæ, calcium oxalate rosette aggregates, tracheæ, simple pores, secretory cells with yellowish-brown resinous contents. *Solvents:* diluted alcohol extracts virtues completely; water or alcohol alone only partially, each taking out a portion of purgative property, the alcoholic solution being more griping than the aqueous. Dose, gr. 5–20 (.3–1.3 Gm.).

ADULTERATIONS.—False Jalap roots (*Ipomœa simulans, I. orizabensis*), and roots of allied species; immature jalap roots, collected at improper times and containing very little resin; jalap roots deprived of resin by soaking in alcohol, becoming sticky to the touch, darker internally and thereby easily recognized; roots of other species of *Exogonium* and *Ipomœa* genera; mealy jalap, resembling the true root, but with mealy fracture and very few resin cells.

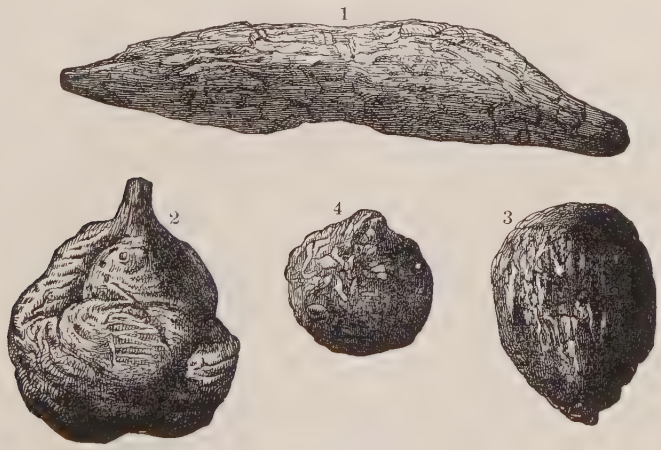


FIG. 325.—Jalap tubers, small sized: *1*, fusiform; *2*, pear-shaped; *3*, date-shaped; *4*, globular.

Commercial.—Plant resembles our Morning-glory, demands rich forest-loam and a climate suitable to Cinchona; grows on the eastern slope of the Mexican Andes, 1,500–2,400 M. (5,000–8,000°) elevation, flourishes well in the Neilgherry, India, and is cultivated in Jamaica. It is trained upon trellises and various supports, and not disturbed until 3 years old and only thereafter every third year. Roots are dug in all seasons (hence varying appearance and strength), but chiefly in the spring, when young shoots appear, and in the autumn (best), after aërial stems have decayed, then washed, placed into nets and

dried by holding over fire (there being no sunshine during the rainy season), which imparts a slight smoky odor and hydrates much of the starch; prior to desiccation the very large pieces are divided into halves, quarters, or transversely that tends to make it less desirable; after drying it is put into bags (100–200 pounds; 45–90 Kg.) and shipped from Vera Cruz.

CONSTITUENTS.—Resin 7–15–22 p. c., starch, gum 15 p. c., sugar 2 p. c., bassorin, coloring matter, ash 5–6.5 p. c.

Resin.—Consists of: 1. *Jalapin* (probably identical with scammonin), 4–10 p. c., soft, waxy, soluble in ether, alkalies, reprecipitated by acids, and medicinally inert. 2. *Jalapurgin, rhodeoretin, convolvulin*, $C_{62}H_{100}O_{32}$, 90–96 p. c., a white, odorless glucoside, hard, insoluble in ether, soluble in alkalies, more of an irritant than jalapin, and the chief active constituent; converted by alkalies into jalapurgic (convolvul(in)ic acid, which is soluble in water), $C_{28}H_{52}O_{14}$, by warming with diluted acids or emulsin into glucose, volatile methyl-ethyl-acetic acid, $C_5H_{10}O_2$, and convolvulic acid, and this latter by continued action into glucose and crystalline convolvulinolic acid, $C_{16}H_{30}O_3$; the name jalapin has unfortunately been assigned to both resins.

FIG. 326.—Jalap tuber: transverse section.

PREPARATIONS.—1. *Pulvis Jalapæ Compositus.* Compound Powder of Jalap. (Syn., Pulv. Jalap. Co., Pulvis Purgans—Catharticus or Jalapæ tartaratus; Fr. Poudre de Jalap composée; Ger. Jalapenpulver mit Weinstein.)

Manufacture: 35 p. c. Triturate together jalap 35 Gm., potassium bitartrate 65; mix thoroughly, pass through No. 60 sieve. It is light brown—numerous sharp, angular, colorless, rectangular fragments, straight-edged, slowly soluble in water or chloral hydrate T. S., strongly polarizing light with strong display of colors (fragments of potassium bitartrate crystals); other elements of identification—tissues of jalap. Dose, gr. 15–60 (1–4 Gm.).

2. *Resina Jalapæ.* Resin of Jalap. (Syn., Res. Jalap.; Br. Jalapæ Resina; Fr. Résine de Jalap; Ger. Jalapenharz.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until the percolate when dropped into water only produces slight turbidity (250 cc.), reclaim alcohol until percolate reduced to 25 Gm., and add this, constantly stirring, to water 300 cc., let precipitate subside, decant supernatant liquid, wash precipitate twice by decantation, each time with hot water 100 cc., drain, dry on water-bath. It is in yellowish-brown masses, fragments, breaking with resinous, glassy fracture, translucent at edges, or yellowish-brown powder, slight, peculiar odor, somewhat acrid taste, permanent, soluble in alcohol, insoluble in carbon disulphide, benzene, fixed or volatile oils; alcoholic solution faintly acid. *Tests:* 1. Shake occasionally for an hour in a stoppered flask 1 Gm. with 20 cc. of chloroform, wash flask and filter with 3

successive 5 cc. portions of chloroform, evaporate combined filtrates, dry residue—should weigh .3 Gm. 2. Dissolve in ammonia water (5) —solution not gelatinous on standing; acidify with hydrochloric acid—only slight turbidity (abs. of rosin, guaiac, other resins). *Impurities:* Rosin, guaiac, aloin, acid resins, other resins, water, soluble substances. Dose, gr. 1–5 (.06–.3 Gm.).

Preps.: 1. *Pilulæ Hydrargyri Chloridi Mitis Compositæ*, ⅓ gr. (.02 Gm.). 2. *Pilulæ Catharticæ Vegetabiles, N.F.*, ⅓ gr. (.02 Gm.).

3. *Fluidextractum Jalapæ, N.F.*, 100 p. c. root (7 p. c. resin—alcohol). Dose, ♏ij–10 (.3–.6 cc.).

4. *Tinctura Jalapæ, N.F.*, 20 p. c. root (1.4 p. c. resin—67 p. c. alcohol). Dose, ʒss–1 (2–4 cc.).

5. *Tinctura Jalapæ Composita, N.F.*, 12.5 p. c. (root) + resin of ipomœa 3 p. c. (67 p. c. alcohol.) Dose, ʒss–1 (2–4 cc.).

Unoff. Preps.: Abstract (alcohol), gr. 2–5 (.13–.3 Gm.). Extract (alcohol), gr. 2–10 (.13–.6 Gm.).

Fig. 327.—*Convolvulus Scammonia: a*, blooming plant, *b*, fruiting twig; *c*, root (¼ natural size); also flower, anther, pistil, fruit, seed, diagram of flower, enlarged.

Properties.—Hydragogue cathartic, diuretic. Has no effect until the duodenum is reached, where with the bile it forms a purgative compound that stimulates vascularity, peristalsis, and profuse secretion from intestinal glands, with no action on biliary flow; usually acts in 4

hours. It is less irritating than gamboge, podophyllum, or scammony, but occasionally gripes, nauseates and vomits. Often given to children for worms, as it has little taste and a safe action. Excessive doses produce dangerous hypercatharsis. Jalapurgin (convolvulin) in large doses is likewise an active irritant or poison.

Uses.—Dropsy, constipation, in febrile and inflammatory affections, head troubles; was introduced into Europe early in the 17th century, and is even now quite popular, being combined usually with calomel, cream of tartar, etc.

Allied Plants:

1. *Convol'vulus Scammo'nia, Scam'mony,* U.S.P. (resin) 1820–1900; (root) 1910; W. Asia, Syria, Greece. Perennial twining herb, 6–9 M. (20–30°) long; leaves sagittate, bright green; flowers yellow, funnel-shaped; fruit capsule, 4-seeded. Root, vertical, cylindrical, 10–25 Cm. (4–10′) long, 1–4.5 Cm. ($\frac{2}{5}$–$1\frac{4}{5}$′) thick, grayish-brown, twisted, furrowed, root-scars, hard, heavy; fracture tough with projecting wood-fibers; internally mottled, yellowish porous wood-wedges, separated by whitish parenchyma containing starch and resin; odor slight, jalap-like; taste slightly sweet; acrid. Powder, grayish-brown—starch grains, calcium oxalate prisms, resin cells, tracheæ, wood-fibers, stone and cork cells; solvents: alcohol, ether; contains resin 3–10 p. c., gum, tannin 3 p. c., sugar 15 p. c., starch, extractive. Hydragogue, cholagogue cathartic—acts locally on upper intestine like jalap, but being a greater irritant causes more griping—sometimes fatal purgation; should be combined with aromatics, potassium sulphate and other cathartics; dropsies, cerebral affections, torpid intestines with slimy mucus. Dose, gr. 5–20 (.3–1.3 Gm.); Resin, gr. 3–8 (.2–.5 Gm.).

2. *Convol'vulus Mechoacan'na, Mechoacanna Root.*—Considered by some identical with *Ipomœa pandurata;* occurs in sections, light, whitish, mealy, contains little resin.

IPOMŒA. IPOMEA, *U.S.P.*

Ipomœa orizabensis, *Ledenois.* { The dried root, yielding not less than 15 p. c. total resins nor more than 3 p. c. acid-insoluble ash.

Habitat. Mexico—eastern slopes of Mexican Andes, rainy atmosphere.

Syn. Ipom., Orizaba Jalap Root, Mexican Scammony Root, Fusiform, Light, or Woody Jalap; Br. Ipomœa Radix.

Ip-o-mœ'a. L. fr. Gr. ἴψ, ιπός, a worm, bindweed, + ὁμοῖος, like, resembling—*i. e.*, from the stems' twining habit, resembling the contortions of a worm.

O-ri-za-ben'sis. L. of or belonging to Oriza'ba, a Mexican city, around which it grows and is collected.

Plant.—A climbing vine resembling closely our common "Morning glory," *I. purpu'rea;* stem cylindrical, villous; leaves large, petiolate, cordate, acuminate, villous on veins; corolla campanulate, reddish-

purple; fruit capsule, 2-locular, 1-seeded. Root, large, .3–.6 M. (1–2°) long, fusiform, branching, yellowish, internally whitish; usually in nearly flat transverse slices, 2–12 Cm. ($\frac{4}{5}$–5′) broad, 1–5.5 Cm. ($\frac{2}{5}$–2$\frac{1}{5}$′) thick, brownish, deeply wrinkled, fracture tough, fibrous, cut surface light brown, showing concentric rings from which coarse fibers protrude; odor distinct, aromatic; taste slightly sweet, acrid. Powder, light grayish-brown—starch grains, .003–.035 Mm. ($\frac{1}{8\,3\,2\,5}$–$\frac{1}{7\,1\,0}$′) broad, numerous calcium oxalate crystals, mostly in rosette aggregates, occasionally rhombohedra; fragments of yellowish-brown resin cells, tracheæ, wood-fibers, *Solvent:* alcohol. Dose, gr. 10–30 (.6–2 Gm.).

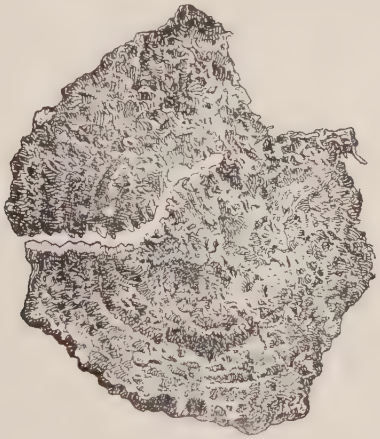


Fig. 328.—*Ipomœa orizabensis:* transverse section (disk), natural size.

Commercial.—Ipomœa root has been made official to replace the more acceptable Levant Scammony Root for some years unobtainable. The two roots differ strikingly in marketable form, Ipomœa being cut when fresh into disks, rapidly dried in the sun, and shipped from Mexico City; internally unlike scammony in not being mottled, in showing regular concentric wood-bundles, in having no stone cells, and calcium oxalate crystals in rosette aggregates rather than monoclinic prisms.

Constituents.—Resin (jalapin, orizabin) 15–18.5 p. c. (75–90 p. c. ether-soluble), starch, gum, tannin, ash 9.89 p. c.

Preparations.—1. *Resina Ipomœæ.* Resin of Ipomea. (Syn., Res. Ipom.; Br. Scammoniæ Resina, Scammony Resin.)

Manufacture: Macerate, percolate 100 Gm. with alcohol until percolate when dropped into water produces only slight turbidity, reclaim alcohol until percolate reduced to a thin syrup, and pour this slowly, stirring constantly, into hot water 100 cc., let resin subside, decant supernatant liquid, wash resin twice by decantation, each time with hot water 100 cc., dry on water-bath. It is in translucent, brownish masses, fragments; fracture resinous, glossy; odor characteristic; soluble in alcohol, chloroform, ether (80–90 p. c.), petroleum benzin (less than 5 p. c.); ash—.5 p. c. *Tests:* 1. Dried to constant weight—

loses not more than 1 p. c. (abs. of water). 2. Dissolves in ammonia T. S. (5) or potassium hydroxide T. S. (5) with turbidity—not gelatinous on standing; these solutions, + little hydrochloric acid— only slight turbidity (abs. of rosin, guaiac, other resins). 3. Triturated with distilled water—latter not colored, as it dissolves none of the resin (abs. of soluble impurities), nor does it acquire bitter taste (abs. of aloin). *Impurities:* Rosin, guaiac, aloin, water-soluble substances, other resins. Dose, gr. 1–5 (.06–.3 Gm.).

Preps.: 1. *Extractum Colocynthidis Compositum,* 14 p. c. 2. *Tinctura Jalapæ Composita, N.F.,* 3 p. c.

PROPERTIES.—Hydragogue, cholagogue cathartic; Root seldom employed internally; resin similar to that of scammony, but a greater irritant and nauseant which may be overcome by combination with other cathartics, and aromatics.

USES.—Dropsies, cerebral affections, torpid intestines with slimy mucus.

Poisoning: Same as for aloe, colocynth, jalap, etc.

Allied Plants:

1. *Ipomœ'a pandura'ta* (*Convolvulus pandura'tus*), *Wild Potato* or *Jalap, Man Root, Man of the Earth.*—The root, U.S.P. 1820–1850; United States. Plant recognized by its fiddle-shaped leaves, stem purplish, climbing 3.5–4.5 M. (12–15°) high; flowers campanulate, white, purplish; root conical, .6–1 M. (2–3°) long, 5–7.5 Cm. (2–3′) thick, in slices, wrinkled, brownish-yellow, milky inside, bark thin with a zone of resin-cells, odor slight, taste sweetish, bitter, acrid; contains resin 1–2 p. c. (glucoside). Diuretic, cathartic in strangury, calculi. Dose, gr. 15–60 (1–4 Gm.).

2. *I. sim'ulans, Tampico Jalap.*—Root irregularly globular or elongated, deeply wrinkled, no transverse ridges—as in the official; yields resin (*tampicin*) 10–15 p. c., nearly all being soluble in ether, and believed identical with resin of scammony.

59. HYDROPHYLLACEÆ. Waterleaf Family.

Hi-dro-fil-la′se-e. L. *Hydrophyll-um* + aceæ, fr. Gr. ὕδωρ, water, + φύλλον, L. *folium,* a leaf—*i. e.,* each leaf has a cavity for holding water. Herbs, shrubs, small trees. Distinguished by being hairy, juicy, leaves hairy, toothed, lobed, pinnately compound; flowers regular, scorpioidal, 5's; ovary 1–2-celled, 2 parietal placentas, styles and stigmas 2; ovules 2–many; fruit, capsule, 2-valved; temperate climates; stimulant, astringent.

Genus: **1. Eriodictyon.**

ERIODICTYON. ERIODICTYON, *U.S.P.*

Eriodictyon californicum, (*Hooker et Arnott*) *Bentham et Torrey.* { The dried leaf with not more than 5 p. c. stems nor 2 p. c. other foreign organic matter.

Habitat. California, Northern Mexico; dry hills, mountains.
Syn. Eriodict., Yerba Santa, Bear's-, Consumptive's- or Tar Weed, Mountain Balm, Gum Plant, Gum-bush.
Er-i-o-dic'ty-on. L. fr. Gr. ἔριον, wool, + δίκτυον, a net *i. e.*, woolly, net-veined leaves.
Cal-i-for'ni-cum. L. *californicus*, California, of or belonging to California—*i. e.*, its habitat.

Plant.—Evergreen shrub, 1–1.5 M. (3–5°) high; stem smooth, resinous; flowers 12 Mm. ($\frac{1}{2}'$) long, bluish-purple, funnel-shaped; 5's,

a *b*

Fig. 329.—Eriodictyon leaves, natural size; *a*, upper surface; *b*, under surface.

racemes. Leaves (Leaf), lanceolate, 5–15 Cm. (2–6′) long, 1–3 Cm. ($\frac{2}{5}$–$1\frac{1}{5}'$) broad, acute, base slightly tapering into short broad petiole, irregularly serrate, crenate-dentate; upper surface yellowish-green, covered with a more or less glistening resin; under surface yellowish-white, conspicuously reticulate with greenish-yellow veins; minutely tomentose between the reticulations; thick, brittle; odor aromatic; taste balsamic, bitter, sweetish. Powder, greenish—non-glandular hairs, glandular hairs, tracheæ, lignified fibers, few starch grains, numerous calcium oxalate crystals in rosette aggregates. *Solvent:* 80 p. c. alcohol. Dose, ʒss–1 (2–4 Gm.).

LABIATÆ

Commercial.—Plant grows among rocks and presents a striking appearance from its shining resinous coating on all green parts.

Constituents.—Volatile oil .1 p. c., resin (complex, nearly soluble in ether) 30 p. c., triacontane, $C_{30}H_{62}$, pentatriacontane, $C_{35}H_{40}O_6$, .23 p. c., eriodictyol, phenol, glucose, phytosterol, tannin, gum.

Preparations.—1. *Fluidextractum Eriodictyi.* Fluidextract of Eriodictyon. (Syn.. Fldext. Eriodict., Fluid Extract of Eriodictyon, Fluidextract of Yerba Santa; Fr. Extrait fluide d'Eriodictyon; Ger. Eriodictyonfluidextrakt.)

Manufacture: Similar to Fluidextractum Colchici, page 111; menstruum: 80 p. c. alcohol; reserve first 80 cc. Dose, ♏xv–60 (1–4 cc.).

Preps.: 1. *Elixir Eriodictyi Aromaticum, N.F.*, 6 p. c., + syrup 50, elix. tarax. co. 44, mag. carb. 1, pumice 3. Dose, ʒj–2 (4–8 cc.). 2. *Syrupus Eriodictyi Aromaticus, N.F.*, 3.2 p. c., + liq. pot. hydrox. 2.5, tr. cardam. co. 6.5, ol. sassaf., ol. limon. āā, $\frac{1}{20}$, ol. caryoph. $\frac{1}{10}$, alcohol 3.2, sucrose 80, mag. carb. $\frac{1}{2}$, water q. s. 100. Dose, ʒj–2 (4–8 cc.).

Unoff. Preps.: Extract, gr. 2–10 (.13–.6 Gm.). Syrup—made like syrup of tolu (pineapple odor and taste).

Properties.—Stimulating expectorant, bitter tonic.

Uses.—Bronchitis, asthma, to disguise bitterness of quinine. *E. tomento'sum* grows along with the official plant, and differs in being larger and having a dense coat of short villous hairs, which become whitish or rust-colored by age; corolla salver-form; leaves oval, obtuse.

Allied Plant:

1. *Verbe'na hasta'ta, Verbena, Blue Vervain.*—Verbenaceæ. The dried overground portion, collected when flowering; N. America. Perennial roughish, pubescent, 1–2.5 M. (3–7°) high; in broken or cut pieces; stem stout, quadrangular, rough, pubescent; leaves opposite, 7–15 Cm. (3–6′) long, lanceolate, acute, serrate, lobed, deep green, petiolate; flowers panicles, spikes; corolla salver-form, 5-lobed, bright blue, didynamous; fruit 4-seeded, 4 nutlets at maturity; odor heavy, taste bitter, astringent, disagreeable; contains bitter glucoside, tannin; solvent: water. Diaphoretic, expectorant, nauseant, antiperiodic, similar to eupatorium. Dose, gr. 15–30 (1–2 Gm.). Fluidextract (dil. alc.); Infusion, 5 p. c.

60. LABIATÆ. Labiate (Mint) Family.

La-bi-a′te. L. *Labi-um(-a)* + atæ, fem. pl. of *labiatus*, lip, lips, lipped —*i. e.*, referring to the irregular or lipped corolla. Herbs, shrubs. Distinguished by abounding in aromatic, stimulant, volatile oils, bitter extractive; stems square, calyx regular, 2-lipped, 5-toothed, corolla irregular, 2-lipped, 4–5-lobed, stamens 4, didynamous, or by abortion 2; leaves opposite, aromatic; ovary 4-lobed, becoming in fruit 4 seed-like monospermous nutlets or achenes, enclosed by persistent calyx;

temperate climates; aromatic, carminative, stimulant (vol. oil), tonic, stomachic (bitter extractive principle), flavoring, perfumery.

Genera: **1. Rosmarinus. 2. Lavandula. 3. Thymus. 4. Mentha.**

ROSMARINUS. ROSEMARY.

Oleum Rosmarini. Oil of Rosemary, *U.S.P.*

Rosmarinus officinalis, *Linné.* — A volatile oil distilled from the fresh flowering tops, yielding not less than 2.5 p. c. esters (bornyl acetate) nor less than 10 p. c. total borneol free and as esters.

Habitat. Mediterranean Basin—Spain to Asia Minor, N. Africa, reaching to Madeira and the Canary Islands; cultivated in gardens.

Syn. Garden Rosemary, Old-man, Folia Rosmarini, Folia Roris Marini, Folia Anthos; Fr. Romarin; Ger. Rosmarin, Meerthau; Ol. Rosmar., Rosemary Oil, Oleum Anthos; Fr. Essence de Romarin; Ger. Rosmarinöl.

Ros-ma-ri'nus. L. *ros*, dew, mist, + *marinus, maris*, of the sea—sea foam—*i. e.*, from its maritime habitat and glaucous appearance. *Rosemary*—not Mary's rose.

Of-fi-ci-na'lis. L. see etymology of (*Smilax*) *officinalis*, page 122.

PLANT.—Small perennial shrub 1–1.3 M. (3–4°) high, bushy, much branched; bark pale brown, twigs tomentose; flowers April-May, bilabiate, upper lip 2-parted, lower 3-divided, middle one being the largest, pale blue; fruit achenes, subglobose, smooth; leaves evergreen, many, sessile, 2.5 Cm. (1′) long, linear, both ends blunt, entire, margins revolute, dark green, shining above, woolly with white, stellate hairs beneath, like the flowers, with aromatic fragrance, camphor-like; taste bitter.

CONSTITUENTS.—Volatile oil 1 p. c., resin, tannin, bitter principle.

Oleum Rosmarini. Oil of Rosemary.—This volatile oil, obtained by distilling the fresh flowering tops with water or steam, is a colorless, pale yellow liquid, characteristic odor of rosemary, camphoraceous taste, soluble in 10 vols. of 80 p. c. alcohol, sp. gr. 0.903, dextrorotatory; contains pinene, $C_{10}H_{16}$, 80 p. c., camphene, cineol, $C_{10}H_{18}O$, camphor, $C_{10}H_{18}$, also at least 2.5 p. c. of esters, calculated as bornyl acetate, $C_{10}H_{17}C_2H_3O_2$, and 10 p. c. of total borneol, $C_{10}H_{17}OH$. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

ADULTERATIONS.—OIL: Oil of turpentine, etc., recognized by odor and not being affected by an equal volume of alcohol, which dissolves out oil of rosemary.

Commercial.—The Dalmatian (Italian) oil of rosemary, distilled after the flowering season is over, and the French, distilled from the flowering tops and of finer odor, are the chief commercial varieties; the English, from cultivated plants, and the Spanish, being high priced are greatly esteemed by some, but little used.

LABIATÆ

PREPARATIONS.—1. *Linimentum Saponis,* 1 p. c. 2. *Tinctura Lavandulæ Composita,* $\frac{1}{5}$ p. c. 3. *Acetum Aromaticum, N.F.,* $\frac{1}{20}$ p. c. 4. *Linimentum Saponato-Camphoratum, N.F.,* $\frac{3}{5}$ p. c. 5. *Oleum Hyoscyami Compositum, N.F.,* $\frac{1}{5}$ p. c. 6. *Spiritus Odoratus, N.F.,* $\frac{7}{10}$ p. c.

Unoff. Preps.: Infusion, 5 p. c.; Spirit (Br.), 10 p. c., ♏x–30 (.6–2 cc.).

PROPERTIES.—Carminative, stimulant, diuretic, diaphoretic, emmenagogue; excessive doses cause death.

USES.—Colic, nervous disorders, menstrual derangements; externally in rheumatism, sprains, bruises. Stimulates the hair in alopecia, reduces temperature, and imparts violet odor to urine; mainly used in liniments, lotions, ointments, perfumery.

FIG. 330.—*Rosmarinus officinalis:* branch and flowers.

FIG. 331.—*Rosmarinus officinalis:* st, stamen with anther; *n*, style with stigma.

Tops or Leaves, U.S.P. 1820–1880.

Allied Plants:

1. *Scutella'ria lateriflo'ra, Scutellaria, Skullcap, Mad-dog, N.F.*—The dried underground portion, with not more than 3 p. c. of foreign organic matter; N. America, United States, damp thickets, ditch banks. Perennial herb .3–.6 M. (1–2°) high; stem branched, smooth, quadrangular; leaves opposite, 5 Cm. (2′) long, ovate-lanceolate, acuminate, coarsely serrate, rounded at base, petiolate; flowers 6 Mm. ($\frac{1}{4}$′) long, 1-sided axillary leafy racemes, pale blue corolla and bilabiate calyx, closed in fruit, upper lip helmet-shaped, including 4 didynamous stamens (upper pair shorter); odor slight; taste slightly bitter. Powder, dark green—numerous non-glandular hairs, glandular hairs, smooth pollen grains, chlorenchyma, epidermal cells and stomata, lignified fibers, narrow tracheæ, occasional epidermal cells of corolla, fragments pink in chloral hydrate T. S.; solvents: diluted alcohol, boiling water; contains scutellarin, volatile oil, tannin, sugar, ash 12 p. c. Tonic, nervine, antispasmodic; epilepsy, hysteria, nervous exhaustion, chorea, delirium tremens, tremors, spasms, muscular twitching, hyperesthesia, neuralgia, convulsions, intermittents, anuresis, hydrophobia. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Scutellariæ*

(diluted alcohol), dose, ʒss–1 (2–4 cc.); 2. *Tinctura Viburni Opuli Composita*, 1 p. c. Decoction, 5 p. c., ʒj–2 (30–60 cc.); Extract, gr. 5–10 (.3–.6 Gm.). *S. integrifo'lia*, hairy, terminal racemes, *S. pilo'sa*, hairy, terminal racemes, leaves in distinct pairs, *S. galericula'ta*, nearly smooth, flowers single, axillary—all used interchangeably.

2. *Nep'eta Cata'ria, Cataria, Catnep, Catmint, N.F.*—The dried leaves and flowering tops with not more than 5 p. c. of stems over 4 Mm. ($\frac{1}{6}'$) thick, or other foreign organic matter; Asia, Europe, naturalized in United States. Perennial herb, .6–1 M. (2–3°) high: Top 10–20 Cm. (4–8′) long, branched, crushed and broken; stems quadrangular, downy; leaves opposite, 2–7 Cm. ($\frac{4}{5}$–3′) long, ovate, cordate, acute, crenate, gray-green, hairy; flowers small, spikes, calyx tubular, 5-toothed, corolla whitish, purple-dotted, bilabiate, crenulate; odor faintly aromatic, mint-like; taste bitter, pungent, aromatic. Powder, grayish-green—parenchyma, palisade tissue with green plastids, numerous non-glandular hairs, glandular hairs, stomata, few collenchyma and lignified wood-fiber bundles; solvent: diluted alcohol; contains volatile oil, bitter principle, tannin, gum, fixed oil, ash 16 p. c. Carminative, stimulant, tonic, diaphoretic, emmenagogue, antispasmodic, aphrodisiac (cats); hysteria, chlorosis, colic, amenorrhea, toothache. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Catariæ* (43 p. c. alcohol), dose, ʒss–1 (2–4 cc.): Prep.: 1. *Elixir Catariæ et Fœniculi*, 10 p. c., + ol. fœnic. $\frac{1}{5}$, ol. menth. vir., $\frac{1}{10}$, sod. bicarb. $1\frac{3}{4}$, alcohol 15, syrup 20, aq. dest. q. s. 100, dose (infant), ♏x–30 (.6–2 cc.). *Prunel'la (Brunel'la) vulga'ris, Self-heal, Heal-all.* Plant .3 M. (1°) high, flowers purplish-blue, in dense spike, leaves hairy, bitter, astringent.

LAVANDULA. LAVENDER.

Oleum Lavandulæ. Oil of Lavender, *U.S.P.*

Lavandula spica, *Linné.* — A volatile oil distilled from the fresh flowering tops, yielding not less than 30 p. c. esters, calculated as linalyl acetate.

Habitat. S. Europe (France, Italy, Spain), N. W. Africa—sunny hills and mountains; cultivated.

Syn. True (Garden, Spike, Common) Lavender, Flores Lavandulæ; Fr. Lavande Vraie,—officinale; Ger. Lavendelblüten; Ol. Lavand., Oleum Lavandulæ Florum, U.S.P. 1900; Fr. Essence de Lavande; Ger. Lavendelöl.

La-van'du-la. L. fr. *lavo, lavare*, to wash—*i. e.*, medieval name, in allusion to the use made of its distilled water for bathing.

Spi'ca. L. *spica*, a point, spike—*i. e.*, flowers arranged in a spike: terminal cluster.

Plant.—Shrub .3–1 M. (1–3°) high; stem crooked, branched, bark brownish-gray, much cleft when old; leaves linear, sessile, entire, revolute margins, with whitish down, crowded at bases of the quadrangular

branches; flowers June-July, lilac-color, terminal spikes, 2-lipped, hairy, glandular; entire plant delightfully fragrant.

CONSTITUENTS.—Volatile oil 1–3 p. c., resin, tannin.

Oleum Lavandulæ. Oil of Lavender.—A colorless, yellow liquid, characteristic odor and taste of lavender flowers, soluble in 3 vols. of 70 p. c. alcohol, sp. gr. 0.881, levorotatory; contains a terpene, $C_{10}H_{16}$, 2 alcohols—geraniol, $C_{10}H_{18}O$, and (chiefly) linalool, $C_{10}H_{18}O$, also, its compound ester—linalyl acetate, $C_{10}H_{17}C_2H_3O_2$, 30–36 p. c., upon which the value depends, and a little cineol—a large quantity of this latter proving the presence of oil of spike (wild broad-leaved variety). When cold deposits stearoptene, and if distilled from leaves and stalks the odor is more rank. *Tests:* 1. Shake in a narrow glass cylinder with equal volume of distilled water—volume not diminished (abs. of alcohol). The *French* oil is from flowers, sometimes including leaves, of wild plants collected July–Sept., the late and high altitude products being best—chief

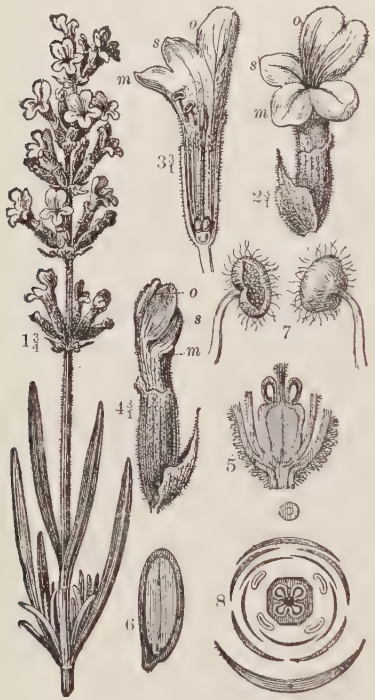


FIG. 332.—*Lavandula spica:* 1, flowering twig; 2, flower with sepal; 3, longitudinal section of flower; 4, flower bud; 5, vertical section of flower bud with ovary; 6, vertical section of little nut; 7, stamens; 8, diagram of flower.

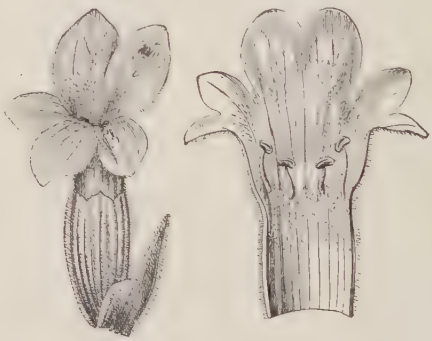


FIG. 333.—Lavender flower and corolla: magnified 4 diam.

commercial article; the *English* oil (oil of garden lavender) is solely from flowers of cultivated plants, the yield being small and price high. Should be kept cool, dark, in well-stoppered amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

ADULTERATIONS.—Oil of turpentine—less soluble in alcohol; oil of sweet basil (*Oc'imum Basil'icum*), Asia, Africa—plant cultivated in gardens for seasoning food and for its white or reddish flowers; oil balsamic, aromatic, possessing a cooling taste.

PREPARATIONS.—1. *Spiritus Lavandulæ.* Spirit of Lavender. (Syn., Sp. Lavand.; Fr. Alcoolat (Esprit, Eau) de Lavande; Ger. Lavendelspiritus.)

Manufacture: 5 p. c. Dissolve oil 5 cc. in alcohol q. s. 100 cc. Dose, ℥ss–1 (2–4 cc.).

2. *Tinctura Lavandulæ Composita.* Compound Tincture of Lavender. (Syn., Tr. Lavand. Co., Compound Spirit of Lavender, Lavender Drops; Fr. Teinture de Lavande composée; Ger. Zusammengesetzte Lavendeltinktur.)

Manufacture: $\frac{4}{5}$ p. c. Similar to Tinctura Cardamomi Composita, page 137—using oil of lavender .8 cc., oil of rosemary .2, cinnamon 2 Gm., clove .5, myristica 1, red saunders 1, macerating powders in alcohol 75 cc., in which the oils have been dissolved, and water 25 cc., finishing with 75 p. c. alcohol. Dose, ℥ss–1 (2–4 cc.).

FIG. 334.—*A, Marrubium vulgare* (Nat.); *a*, calyx (× 3). *B*, spurious marrubium (Nat.); *b*, calyx (× 3).

Prep.: 1. *Liquor Potassii Arsenitis,* 3 p. c. (arsenic trioxide 1 p. c., potassium bicarbonate 2 p. c.).

3. *Linimentum Saponis Mollis,* 2 p. c. 4. *Spiritus Ammoniæ Aromaticus,* $\frac{1}{10}$ p. c. 5. *Unguentum Plumbi Oleatis,* 1 p. c. 6. *Acetum Aromaticum, N.F.,* $\frac{1}{20}$ p. c. 7. *Mistura Oleo-Balsamica, N.F.,* $\frac{2}{5}$ p. c. 8. *Oleum Hyoscyami Compositum, N.F.,* $\frac{1}{5}$ p. c. 9. *Petroxolinum Liquidum, N.F.,* $\frac{1}{2}$ p. c. 10. *Petroxolinum Spissum, N.F.,* 3 p. c. 11. *Spiritus Odoratus, N.F.,* $\frac{2}{5}$ p. c.

Unoff. Preps.: Water, $\frac{1}{5}$ p. c. Infusion and Fomentation (flowers).

PROPERTIES.—Stimulant, carminative, nervine, errhine.

LABIATÆ

USES.—Gastralgia, nausea, flatulence, to correct nauseating medicines, nervous headache; mostly in perfumery.

Flowers, U.S.P. 1840–1880. *Oil of Lavender Flowers*, U.S.P. 1880–1900, distilled from the fresh flowers. *L. Stœ'chas, Arabian (French)*

FIG. 335.—*Salvia officinalis.*

FIG. 336.—*Salvia officinalis*, flower: *a*, *b*, filaments; *c*, connective; *d*, fertile anthers; *e*, sterile anthers.

Lavender, has dark purple flowers, aromatic camphoraceous odor, and is used, with other varieties, for obtaining the oil.

FIG. 337.—Sage leaf: *a*, upper surface; *b*, lower surface.

Allied Plants:

1. *Marru'bium vulga're, (White, Common) Horehound.*—The dried leaves and flowering tops, U.S.P. 1820–1900; Europe, C. Asia, N. America, cultivated in waste places, gardens, etc. Perennial herb .3–.6 M. (1–2°) high, with short rootstock; stems numerous, annual, branched below, quadrangular, tomentose, woolly; leaves 1.5–5 Cm. ($\frac{3}{5}$–2′) long, opposite, petiolate, roundish-ovate, obtuse, coarsely crenate, strongly rugose-veined, white-hairy; flowers whitish, in dense, axillary whorls, calyx 10-toothed, divisions slightly unequal, erect-spreading, pungent; corolla small, bilabiate, 4 included stamens; fruit of 4 ovoid, obtuse, nearly smooth nutlets, 1.5 Mm. ($\frac{1}{16}$′) long; odor distinct, agreeable; taste aromatic, bitter; solvents: diluted alcohol, boiling water; contains volatile oil, marrubiin (bitter amaroid), $C_{21}H_{28}O_4$, .02–4 p. c., resin, tannin, gum, albumin, salts. Stimulant, tonic, bitter stomachic, expectorant, resolvent, anthelmintic (large doses—diuretic, diaphoretic, laxative); dyspepsia, bronchitis, chronic hepatitis, jaundice, amenorrhea, phthisis, cachexia, catarrh, chronic

rheumatism, intermittents. Dose, ʒss–1 (2–4 Gm.); extract, gr. 5–10 (.3–.6 Gm.); fluidextract, ʒss–1 (2–4 cc.); infusion (sweetened and flavored to liking), 5 p. c., ʒj–2 (30–60 cc.); juice (Succus Marrubii), ʒj–2 (4–8 cc.), in honey or milk; owing to bitterness, the lozenge (cough drop) is the most popular form for administration.

2. *Sal'via officina'lis*, (*Garden, Meadow*) *Sage.*—The dried leaves, U.S.P. 1840–1900; S. Europe, warm stony places; cultivated universally. Perennial; stem semi-shrubby, .6 M. (2°) high, quadrangular,

Fig. 339.—*Hedeoma pulegioides.*

Fig. 338.—*Monarda punctata:* flower magnified.

Fig. 340.—*Hedeoma pulegioides:* flower and corolla, magnified.

gray-pubescent, branched; flowers, cymes, blue with white and purple, on woolly stalks, calyx tubular, 2-lipped, upper with 3, lower with 2 acute teeth; corolla tubular, bilabiate, lower in 3 rounded lobes, central one largest; fruit 4 achenes; seed solitary. Leaves ovate-oblong, 3–7.5 Cm. ($1\frac{1}{5}$–3′) long, apex subacute, base subcordate, crenulate, thick, grayish-green, reticulate-veined, pubescent, petiolate; odor aromatic; taste aromatic, bitter, astringent; should be collected when flowering and dried carefully; solvents: diluted alcohol, boiling water; contains volatile oil .5–2 p. c., resin, tannin, bitter principle (similar to

amaroid marrubiin), gum. Stimulant, tonic, astringent, vulnerary, condiment; dyspepsia, colliquative sweats, seasoning fat fowl, pork; infusion (externally)—ulcers of mouth, throat, indurated sores, nasal catarrh, suppression of mammary secretion; gargle may be sweetened (sugar, honey) and have added vinegar, alum, borax, potassium chlorate, etc.; ancients valued it highly. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ♏xv–60 (1–4 cc.); infusion, 5 p. c., ℥j–2 (30–60 cc.); water (Aqua Salviæ), distil 1 part with water 10; gargle. *S. praten'sis*, S. Europe; *S. lyra'ta*, N. America, slightly aromatic, and *S. polysta'chya*, *Chia-seed*, Mexico, are aromatic and bitter, all being used interchangeably; infusions of either produce (hot) or check (cold) excessive sweating.

3. *Monar'da puncta'ta*, *Horse-mint.*—The leaves and tops, U.S.P. 1820–1870; United States. Perennial, .6–1 M. (2–3°) high, stem branched, downy, leaves 5–7.5 Cm. (2–3′) long, lanceolate, serrate, punctate, flowers yellow, spotted red with pinkish bracts, downy, calyx 5-toothed, aromatic, pungent, bitter; contains volatile oil. Carminative, stimulant, emmenagogue, nervine, diaphoretic, diuretic; flatulent colic, nausea, rheumatism, neuralgia, diarrhea; in infusion. Dose, gr. 15–60 (1–4 Gm.). *Oleum*

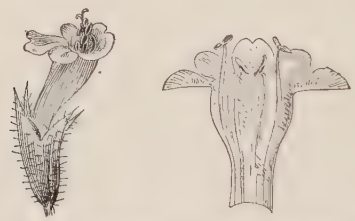


Fig. 341.—*Melissa officinalis:* flower and corolla, magnified.

Fig. 342.—*Melissa officinalis:* leaf.

Monardæ (volatile oil), U.S.P. 1820–1870, is yellowish or reddish, sp. gr. 0.930; contains terpene, $C_{10}H_{16}$, 50 p. c., thymol (monardin), $C_{10}H_{14}O$, 25–61 p. c., also alcohol, $C_{10}H_{18}O$, and its acetic, butyric, and formic esters.

4. *Hedeo'ma pulegioi'des*, (*American*) *Pennyroyal.*—The dried leaves and flowering tops, U.S.P. 1830–1900; N. America, sandy fields, hills, open woods, scenting the atmosphere. Annual herb; stem 25–37.5 Cm. (10–15′) high, quadrangular, pubescent, branched; root fibrous, yellowish. Leaves opposite, 15–35 Mm. ($\frac{3}{5}$–$1\frac{2}{5}$′) long, thin, obtuse, obscurely serrate, glandular-hairy beneath, petiolate; flowers, axillary fascicles; calyx tubular, 5-toothed, bilabiate; corolla pale blue, spotted, bilabiate, containing 2 sterile and 2 fertile stamens; odor strong, mint-like; taste aromatic, pungent; solvents: alcohol, boiling water par-

tially; contains volatile oil 1 p. c., bitter principle, tannin. Stimulant, carminative, emmenagogue, aromatic; flatulent colic, nausea, indigestion, corrective to purgatives; hot infusion—diarrhea, bronchitis, rheumatism, amenorrhea (hot hip and foot baths); odor repulsive to fleas, mosquitoes, etc.; large doses, for suppressed catamenia or for inducing abortion, have occasioned death from narcosis. Dose, gr. 15–60 (1–4 Gm.); fluidextract (diluted alcohol), ʒss–2 (2–8 cc.); infusion, 5 p. c., ʒij (60 cc.), every hour; spirit (oil 1, + alcohol 9), externally and in spray. Volatile oil (Oleum Hedeomæ), U.S.P. 1820–1900, often added to liniments as a rubefacient. *Mentha Pule'gium, European Pennyroyal*, resembles closely the above, having oval, serrate leaves, and purplish flowers, cymes, corolla 4-lobed; *Hedeoma piperi'ta*, Mexico, is used for peppermint, while *H. thymoi'des*, Texas, having more agreeable odor, as aromatic, diaphoretic.

5. *Melis'sa officina'lis, Melissa, Balm.*—The leaves and tops, U.S.P. 1840–1890; Asia Minor, S. Europe. Perennial herb with fragrance of lemons, growing in waste places; stems several, quadrangular, .3–1 M. (1–3°) high, branched at base, pubescent; flowers yellowish-white, purplish, calyx 5-toothed, tubular, bell-shaped; corolla bilabiate, 4 stamens. Leaves, 5 Cm. (2′) long, petiolate, ovate, obtuse, crenate, hairy, glandular, branches square; fragrant, aromatic, astringent, bitter; contains volatile oil .25 p. c., bitter principle, tannin, gum; solvents: diluted alcohol, boiling water. Carminative, diaphoretic, stimulant, antispasmodic; used as a refreshing drink; when cold for febrile affections, when hot acts slightly on the skin. Dose, gr. 15–60 (1–4 Gm.); water (Aqua Melissæ), leaves (1) distilled with water (10); compound spirit (Spiritus Melissæ Compositus), balm 14 + lemon peel 12, nutmeg 6, cinnamon 3, clove 3, alcohol 150, water 250, distil 200 parts; fluidextract, ♏xv–60 (1–4 cc.); infusion, ʒj–2 (30–60 cc.); oil, ♏j–2 (.06–.13 cc.).

6. *Orig'anum vulga're, Wild Marjoram.*—The herb, U.S.P. 1820–1850; 1870–1880; Asia, Europe, N. Africa, naturalized in N. America. Perennial herb, .3–.5 M. (12–18′) high; stem square, purplish, downy; leaves 2.5 Cm. (1′) long, ovate, entire, pellucid-punctate, hairy beneath, flowers pale purple, calyx 5-toothed, corolla 2-lipped, 4 exserted didynamous stamens, aromatic, pungent, bitter; contains volatile oil 1 p. c., bitter principle, resin, tannin. *Oleum Origani*, U.S.P. 1820–1850, 1870; consists mainly of terpene, $C_{10}H_{16}$. Carminative, stimulant, emmenagogue, diaphoretic, tonic, fomentation; dyspepsia, indigestion, nausea, colic, rheumatism, neuralgia; in infusion. Dose, gr. 15–60 (1–4 Gm.); oil used in liniments, carious teeth, flatulence, ♏v–10 (.3–.6 cc.). The closely allied *Origanum Majora'na, Sweet Marjoram*, is cultivated largely, being used as a condiment in cooking.

7. *Ly'copus virgin'icus, Bugle Weed.*—The herb, U.S.P. 1830–1870; N. America. Plant has smooth, obtusely quadrangular stem, 15–60 Cm. (6–24′) high; leaves 5 Cm. (2′) long, elliptic, glandular; flowers

purple, 4-lobed, stamens 2, mint odor and bitter taste, root perennial, creeping; contains volatile oil, resin, bitter principle, tannin. Astringent, tonic, sedative, narcotic; hemorrhage, diarrhea, dysentery; infusion, decoction. Dose, gr. 5–30 (.3–2 Gm.).

THYMUS. THYME, *N.F.*

Thymol. **Thymol,** $C_{10}H_{14}O$, *U.S.P.*

Thymus vulgaris, *Linné.* { A phenol occurring in the volatile oil of this and other plants.

Habitat. S. Europe (Portugal to Greece); cultivated in gardens, etc.

Syn. Common Garden Thyme, Mother of Thyme; Acidum Thymicum, Thymic Acid, Methyl-propyl phenol; Fr. Acide Thymique; Ger. Herba Thymi, Thymian; Thymolum, Thymiansäure.

Thy'mus. L. fr. Gr. *θύμος*, strength, its invigorating smell. Used in temples as incense.

Vul-ga'ris. L. ordinary, common—*i. e.*, the kind growing wild and in common use.

Plant.—Small shrub, 25–30 Cm. (10–12′) high; stem and branches quadrangular; bark pale brown, shoots purplish; stems .5 Mm. ($\frac{1}{50}$′) thick, grayish-brown, pubescent, nodes 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) apart. Thymus, Thyme, *N.F.* Leaves and flowering tops with not more than 3 p. c. of stems over 1 Mm. ($\frac{1}{25}$′) thick, or other foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash. Leaves linear-lanceolate, ovate, .5–6 Mm. ($\frac{1}{50}$–$\frac{1}{4}$′) long, .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) broad, acute, base tapering into short petiole, revolute, grayish-green, puberulent, many non-glandular hairs, grayish, pubescent beneath; numerous glandular secreting hairs above, depressed in cuticle giving glandular-punctate appearance; flowers polygamous, bilabiate, small, pubescent, upper lip 3-toothed, lower 2-toothed, purplish; fruit nutlets, .5 Mm. ($\frac{1}{50}$′) broad, spheroidal. Powder, light-green—non-glandular hairs 2 types, glandular hairs 2 types, leaf chlorenchyma with vascular tissue and epidermal cells, stomata, pollen grains.

Constituents.—Volatile oil 2.5 p. c. (thymol), resin, tannin, gum, ash 14 p. c.

Oleum Thymi. **Oil of Thyme,** *N.F.*—A volatile oil distilled from the flowering plant containing not less than 20 p. c., by volume, of phenols. It is a colorless or red liquid, characteristic odor and taste, soluble in 2 vols. 80 p. c. alcohol, sp. gr. 0.912, levorotatory; contains at least 20 p. c., by volume, of phenols, also cymene, $C_{10}H_{14}$, *l*-pinene, borneol, linalool; the phenol content in the French and German oil, amounting to 25–42 p. c., is mostly thymol, but sometimes carvacrol, or a mixture of the two, whereas in the Spanish oil it is chiefly carvacrol, amounting to 50–70 p. c. *Adulterations:* Oil of turpentine which lowers specific

gravity and increases angle of rotation, while wild thyme oil only does the latter. *Test:* 1. Shake 1 cc. with hot distilled water 10 cc., cool, pass aqueous layer through a wetted filter—filtrate not blue or violet with a drop of ferric chloride T. S. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

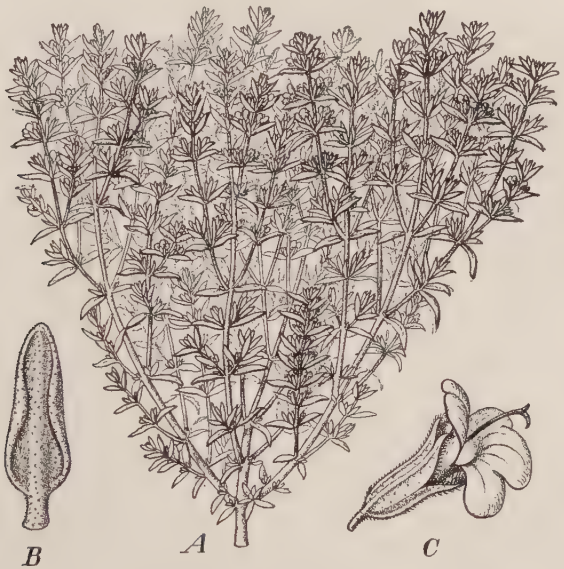


Fig. 343.—*Thymus vulgaris: A*, plant in bloom; *B*, leaf seen from under surface, magnified 4 diam.; *C*, flower seen from the side, magnified 5 diam.

Thymol. **Thymol,** *U.S.P.*—This monatomic phenol, occurring in the volatile oils of *Thymus vulgaris*, *Monarda punctata*, and *Ptycho'tis Cop'tica* (*Ajowan*—Umbelliferæ), the latter alone supplying most of the commercial article, is obtained by subjecting to freezing the residue left upon distilling any of these oils below 200° C. (392° F.), whereby thymol crystallizes out; or may agitate this residue with sodium hydroxide solution, and after a time add hot water to separate sodium thymol ($NaC_{10}H_{13}O$) solution from thymene, and to allow unattacked oil to float on top; to sodium hydroxide solution add hydrochloric acid which sets thymol free as an oily layer and upon cooling crystallizes when a crystal of thymol is added; yield 20–61 p. c. It is in large colorless, translucent, rhombic prisms, aromatic, thyme-like odor, pungent, aromatic taste, very slight caustic effect upon the lips; soluble in glacial acetic acid, fixed or volatile oils, water (1000), alcohol (1), chloroform (.7), ether (1.5), olive oil (1.7); alcoholic solution (1 in 20) neutral, optically inactive; isomeric with carvone (carvol, carvacrol); as a solid heavier than water, when liquefied by fusion lighter than water, melts at 50° C. (122° F.); liquefies when triturated with equal weight of

camphor or menthol. *Tests:* 1. Dissolve a small crystal in glacial acetic acid 1 cc., add sulphuric acid 6 drops and nitric acid 1 drop—liquid deep bluish-green by reflected light. 2. Heat 1 Gm. with 5 cc. of a 10 p. c. solution of sodium hydroxide—clear, colorless, or pale red solution, darker on standing, without separating oily drops; add few drops of chloroform, agitate—violet color; volatilize 2 Gm. on water-bath—residue .05 p. c. 3. Alcoholic solution (1 in 20), + ferric chloride T. S. —not violet (abs. of phenol). *Impurities:* Phenol, etc. Should be kept in well-closed containers. Dose, antiseptic, gr. 1–5 (.06–.3 Gm.); anthelmintic, gr. 15 (1 Gm.), per die.

PREPARATIONS.—THYMOL: 1. *Nebula Thymolis, N.F.*, 1 p. c. 2. *Cataplasma Kaolina, N.F.*, $\frac{1}{20}$ p. c. 3. *Liquor Antisepticus, N.F.*, $\frac{1}{10}$ p. c. 4. *Liquor Aromaticus Alkalinus, N.F.*, $\frac{1}{20}$ p. c. 5. *Liquor Procainæ Hydrochloridi, N.F.*, $\frac{1}{50}$ p. c. 6. *Nebula Aromatica, N.F.*, $\frac{1}{10}$ p. c. 7. *Petroxolinum Sulphuratum Compositum, N.F.*, $\frac{3}{10}$ p. c. 8. *Pulvis Antisepticus, N.F.*, $\frac{1}{10}$ p. c. OIL: 1. *Linimentum Saponato-Camphoratum, N.F.*, $\frac{3}{10}$ p. c. 2. *Liquor Antisepticus, N.F.*, $\frac{1}{33}$ p. c. 3. *Mistura Oleo-Balsamica, N.F.*, $\frac{2}{5}$ p. c. 4. *Oleum Hyoscyami Compositum, N.F.*, $\frac{1}{5}$ p. c. THYME: 1. *Fluidextractum Thymi, N.F.* (1st menstruum: glycerin 10, alcohol 25, water 65, 2d: 25 p. c. alcohol). Dose, ♏xv–60 (1–4 cc.): Prep.: 1. *Syrupus Thymi, N.F.*, 20 p. c.: Prep.: 1. *Syrupus Thymi Compositus, N.F.*, 50 p. c. Dose, ʒj–2 (4–8 cc.).

Unoff. Preps.: THYMOL: Capsules. Inhalation, 1 gr. (.06 Gm.) in each. Ointment, 1–5 p. c., Pills.

PROPERTIES.—THYMOL: Stimulant, antiseptic, deodorant, disinfectant, parasiticide, antipyretic, local anesthetic; anthelmintic. Its action stands between phenol and oil of turpentine, being 10 times less poisonous than the former, yet a far more powerful and permanent antiseptic; it is anesthetic to the skin and mucous membranes, paralyzing the ends of sensory nerves; it is eliminated by breath and urine. OIL: Stimulant, tonic, emmenagogue, antispasmodic. If excessive doses given, have vomiting, depression, coldness, death by exhaustion, increased urine, which acquires green color and violet odor.

USES.—THYMOL: Precisely like the oil, not much internally, except for fermentative gastritis, and hook-worm; for this latter give on an empty stomach gr. 15–30 (1–2 Gm.) mixed with an equal quantity of lactose, repeat in 2 hours and follow 2 hours later, by full dose of Epsom salt, or compound cathartic pills (avoid castor oil); mostly externally as an antiseptic in surgery, to lessen fetor from sores, ulcers, gangrene, in stomatitis, diphtheria, fetid bronchitis, coryza, rhinitis, ozena, conjunctivitis, otorrhea, gonorrhea, uterine lochia, cancer, leucorrhea, warts, skin diseases (psoriasis, eczema, etc.), diarrhea, dysentery, typhoid fever, diabetes. A good dressing is thymol 1 Gm., alcohol 10 cc., glycerin 30, water q. s. 1000 cc. Flies are fond of and often become attracted by it, which is its only objection. *Poisoning:* Have nausea, vomiting, headache, dizziness, weakness, ringing in the

ears, thready pulse, low temperature—treat symptoms, withdraw drug. Oil: Chlorosis, rheumatism, neuralgia, bronchitis, diarrhea, gleet, gonorrhea, leucorrhea, vesical catarrh; externally in baths, lotions for scabies, muscular rheumatism, to correct fetor from sores, ulcers, gangrene. Applied to cotton for toothache, earache, for veterinary practice, scenting soap.

Thymacetin, $C_6H_2.CH_3OC_2H_5C_3H_7NH.COCH_3$, a derivative, has the same relation to thymol that phenacetin has to phenol, and is prepared similarly; it is a white crystalline powder, soluble in alcohol, slightly in water. Analgesic, hypnotic, antiseptic; used in neuralgic headache like phenacetin. Dose, gr. 5–15 (.3–1 Gm.).

Thyme plant (fresh) is used as a condiment to aid digestion of fat pork, goose, duck, etc., and to flavor insipid dishes, as is sage, marjoram, parsley; it is used also with other aromatic herbs in baths, cataplasms, fomentations, for rheumatism, gout, scabies, indolent ulcers.

MENTHA VIRIDIS. SPEARMINT, *U.S.P.*

Mentha spicata, *Linné.*
(**Mentha viridis,** *Linné.*)

The dried leaves and tops with not more than 2 p. c. of stems over 3 Mm. ($\frac{1}{8}'$) thick, or other foreign organic matter.

Habitat. England, wild in Europe, N. America; cultivated in the United States.
Syn. Menth. Vir., Mint, Mackerel, Lady's, Brown, Lamb or Common Garden Mint, Lammint, Sage of Bethlehem, Herba Menthæ Romanæ (Acutæ); Fr. Menthe (romaine) verte, Baume vert; Ger. Grüne Minze, Römische Minze.
Men'tha. L. fr. Gr. *μίνθη*, Minthe, a nymph, daughter of Cocytus, fabled to have been changed into a mint plant by Proserpine in a fit of jealousy (Theophrastus).
Spi-ca'ta. L. spiked—*i. e.*, the flowers.
Vir'i-dis. L. green—*i. e.*, the stem.
Spear'mint—spur + *mint*, from its spiry, spear-like inflorescence.

Plant.—Perennial herb; rootstocks with elongated suckers, by which it multiplies extensively; stems .6–1.3 M. (2–4°) high, acutely quadrangular, branches opposite, smooth, often tinged with purple; flowers Aug.-Sept., spikes, calyx tubular, 5-toothed, corolla 4-lobed, light purple. Leaves, ovate-lanceolate, 1–9 Cm. ($\frac{2}{5}$–$3\frac{3}{5}'$) long, unequally serrate, nearly sessile, or petiole only 4 Mm. ($\frac{1}{6}'$) long, bright green, somewhat glandular-hairy on under surface; more or less crumpled and mixed with large proportion of the light brown, purplish stems, occasionally with their characteristic opposite branches; stems distinctly quadrangular, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}'$) thick, nearly glabrous; flowers in opposite clusters, or more or less interrupted or crowded, lanceolate, nearly acute spikes; bracts linear-lanceolate, subulate, 7–10 Mm. ($\frac{1}{4}$–$\frac{2}{5}'$) long, subtending the flower clusters; calyx tubular, 5-toothed, glandular-punctate, somewhat pubescent near the teeth;

corolla nearly white, light brown; stamens exserted; odor slightly pungent, characteristic; taste aromatic, characteristic, not followed by cooling sensation in the mouth. POWDER, green—closely resembles that of peppermint but without crystals from the globular heads of the glandular hairs. Should be collected in dry weather, Aug.–Sept., just as flowers appear, if for oil, just after flowers have expanded, and is heavier, weaker and less pungent than peppermint, being probably the cultivated form of *M. longifo'lia* (*sylves'tris*), *Horse-mint;* loses on drying 75–85 p. c. *Solvents:* alcohol; water partially. Dose, gr. 30–60 (2–4 Gm.).

ADULTERATIONS.—Mostly through carelessness—leaves of other *Mentha* species, chiefly *M. piperita*, sometimes 30 50 p. c. in that coming from the South (Va., N. Ca., S. Ca.); its own odor and taste (lack of coldness), unequally serrate sessile leaves, slender interrupted spikes, and long calyx teeth should suffice for ready recognition.

CONSTITUENTS.—Volatile oil .5 p. c., resin, tannin, gum.

FIG. 344.—*Mentha spicata* (*viridis*): flowering tops.

FIG. 345.—*Mentha spicata* (*viridis*): leaf, natural size.

Oleum Menthæ Viridis. Oil of Spearmint, *U.S.P.*—(Syn., Ol. Menth. Vir., Spearmint Oil; Fr. Essence de Menthe verte; Ger. Krauseminzöl, Romisch Minzöl.) This volatile oil, distilled from the flowering plant (fresh or partly dried) is a colorless, yellow, greenish-yellow liquid, characteristic odor and taste of spearmint; soluble in 80 p. c. alcohol (1) with clear solution that becomes cloudy on further dilution with alcohol, sp. gr. 0.925, levorotatory; contains at least 43 p. c. of

carvone, $C_{10}H_{14}O$, limonene, $C_{10}H_{16}$, 43 p. c., possibly pinene, $C_{10}H_{16}$, and an unidentified alcohol, $C_{10}H_{17}OH$. It is preserved for a long time by adding 3–4 p. c. of alcohol. Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

PREPARATIONS.—LEAVES AND TOPS: 1. *Spiritus Menthæ Viridis.* Spirit of Spearmint. (Syn., Sp. Menth. Vir., Essence of Spearmint, Tinctura Olei Menthiæ Viridis; Ger. Grüne Minzessenz.)

Manufacture: Macerate for 1 hour spearmint leaves 1 Gm. in water 50 cc., strongly express; mix oil of spearmint 10 cc. in alcohol 80, add macerated leaves, and alcohol q. s. 100 cc., macerate mixture for 6 hours, frequently shaking, filter. Should be kept in amber-colored bottles. Dose, ♏x–30 (.6–2 cc.).

Prep.: 1. *Elixir Manacæ Compositum, N.F.,* 1.5 p. c.

OIL: 1. *Aqua Menthæ Viridis.* Spearmint Water. (Syn., Aq. Menth. Vir.; Fr. Eau de Menthe verte; Ger. Römisch Minzwasser.)

Manufacture: $\frac{1}{5}$ p. c. Similar to Aquæ Aromaticæ: shake often during 15 minutes, oil .2 cc. with distilled water 100, in a capacious bottle, set aside 12 hours or more, filter, adding distilled water q. s. 100 cc., or triturate oil .2 cc. with purified talc 1.5 Gm. and recently boiled distilled water q. s. 100 cc., filter until clear. Dose, ℥ss-1 (15–30 cc.).

Prep.: 1. *Liquor Sodæ et Menthæ, N.F.,* 98 p. c.

2. *Spiritus Menthæ Viridis,* 10 p. c. 3. *Elixir Catariæ et Fœniculi, N.F.,* $\frac{1}{10}$ p. c.

Unoff. Preps.: LEAVES AND TOPS: *Infusion,* 5 p. c., ℥j–2 (30–60 cc.). *Fluidextract,* ℥j–2 (4–8 cc.). LEAVES AND TOPS, OR OIL: *Syrup,* ℥j–4 (4–15 cc.).

PROPERTIES.—Carminative, stimulant, nervine; flavoring.

USES.—Same as peppermint, but as it is much milder it is to be preferred in disorders of infancy, culinary purposes, confectionery, prefumery—flavoring chewing gum, world celebrated mint julep, mint sauce, peas and other green vegetables.

Allied Plants:

1. *Mentha cris'pa, Crisped-leaved, Cross* or *Curled Mint.*—This is the cultivated form of *M. spicata* (*viridis*), known also as *M. aquat'ica* var. *crispa,* leaves pubescent, cordate pointed, crisped; *M. sati'va, M. arven'sis,* and *M. rotundifo'lia,* are under cultivation and sometimes produce similar crisped leaves.

2. *Hysso'pus officina'lis, Hyssop.*—S. Europe. Plant .3 M. (1°) high, stem square, leaves 2.5 Cm. (1′) long, punctate on both sides, flowers purplish-blue, stamens 4, exserted; contains volatile oil .5 p. c., bitter principle, resin, fat. Used in Biblical times as a cathartic, now as a carminative, stimulant, sudorific; for dyspepsia, amenorrhea, rheumatism, bruises, bronchitis, sore throat, chronic catarrhs. Dose, gr. 15–60 (1–4 Gm.); infusion, 5 p. c.; oil ♏j–2 (.06–.13 cc.).

MENTHA PIPERITA. PEPPERMINT, *U.S.P.*

Mentha piperita, *Linné.* { The dried leaves and tops with not more than 2 p. c. of stems over 3 Mm. ($\frac{1}{8}'$) thick, or other foreign organic matter.

Habitat. Asia, Europe, N. America; wild in low ground, wet places; cultivated in Japan, Germany, England, Michigan, New York, etc.

Syn. Menth. Pip., Brandy (Lamb) Mint, Lammint, Herba Menthæ Piperitæ; Fr. Menthe poivrée; Ger. Folia Menthæ piperitæ, Pfefferminzblätter.

Pi-pe-ri'ta. L. *piper, pepper*—peppery-mint—*i. e.*, from its aromatic burning taste.

Pep'permint—pepper + *mint—i. e.*, mint with pepper properties.

PLANT. –Perennial herb, possibly from *M. hirsu'ta, Water Mint*, by cultivation; rootstock creeping, producing long suckers by which it multiplies; stem square, purplish, .6–1.3 M. (2–4°) high. LEAVES, ovate-oblong, 1–9 Cm. ($\frac{2}{5}$–$3\frac{3}{5}'$) long, petiole 4–15 Mm. ($\frac{1}{6}$–$\frac{3}{5}'$) long, pubescent, acute, sharply serrate, light green, purplish-brown, upper surface nearly glabrous, lower surface glandular-hairy, especially on veins; more or less crumpled and frequently detached from stems, which are quadrangular, 1–3 Mm. ($\frac{1}{25}$–$\frac{1}{8}'$) thick, glabrous except for

FIG. 346.—*Mentha piperita:* flowering tops.

a few scattered deflexed hairs; flower-whorls in oblong (oval) spikes which are usually compact, or somewhat interrupted at base, 1–1.5 Cm. ($\frac{2}{5}$–$\frac{3}{5}'$) broad, rounded at summit, and in fruit 3–7 Cm. ($1\frac{1}{5}$–$2\frac{4}{5}'$) long; bracts oblong-lanceolate, very acuminate, 4–7 Mm. ($\frac{1}{6}$–$\frac{1}{3}'$) long, calyx tubular, equally 5-toothed, pubescent, glandular-punctate, often dark purplish; corolla tubular-campanulate, 4-cleft, 3 Mm. ($\frac{1}{8}'$) long, often light purple; stamens 4, short; nutlets ellipsoidal, .5 Mm. ($\frac{1}{50}'$) thick, blackish-brown; odor aromatic, characteristic; taste aromatic, pungent, followed by cooling sensation in the mouth. POWDER, green-

ish—leaf epidermis with wavy vertical walls, stomata, non-glandular hairs with papillose walls, glandular hairs with volatile oil and crystals, chlorenchyma, tracheæ, parenchyma, pollen grains. Should be collected in dry weather, Aug.-Sept., when in bloom; strongest and most pungent of all mints. *Solvents:* alcohol; water partially. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—Leaves chiefly of varieties of this species: (*a*) var. *officina'lis*—leaves narrower, spikes longer; (*b*) var. *vulga'ris*—leaves broader, base more rounded, spikes more blunt and close; spearmint leaves, which may readily be distinguished from peppermint which has leaves with petioles, inflorescence thicker and more crowded, flowers larger with shorter calyx-teeth, and its own distinctive odor and taste.

Commercial.—English is regarded best, Japanese is consumed chiefly for obtaining menthol (50–80 p. c.), while United States produces most.

CONSTITUENTS.—Volatile oil 1 p. c. (menthol), resin, tannin, gum, chlorophyll.

Oleum Menthæ Piperitæ. Oil of Peppermint, *U.S.P.*—(Syn., Ol. Menth. Pip., Peppermint Oil; Fr. Essence de Menthe poivrée; Ger.

FIG. 347.—*Mentha piperita:* flower and corolla cut open; magnified 8 diam.

Pfefferminzöl.) This volatile oil, distilled from the fresh, overground parts of the flowering plant and rectified by steam distillation, is a colorless liquid, strong penetrating odor of peppermint, pungent taste, followed by a sensation of cold upon drawing air into the mouth; soluble in 4 vols. of 70 p. c. alcohol, showing not more than slight opalescence and no separation of oil globules (abs. of dementholized or impure peppermint oil), sp. gr. 0.912, levorotatory; contains 16 constituents: at least 5 p. c. of esters, calculated as menthyl acetate, $C_{10}H_{19}C_2H_3O_2$, and 50 p. c. of total menthol, free and as esters; also acetic and isovaleric acids, acetaldehyde, isovaleric aldehyde, amyl alcohol, pinene, phellandrene, limonene, $C_{10}H_{16}$, menthone, $C_{10}H_{18}O$, menthyl isovalerate, menthyl ester, cadinene, $C_{15}H_{24}$, a lactone, dimethyl sulphide; the hydrocarbons holding menthol dissolved are mainly the

several terpenes (English—pinene, phellandrene, sesquiterpene; Japanese—sesquiterpene alone) with carvene odor, the higher boiling ones, $C_{15}H_{24}$, having less pleasant odor; menthol and its esters (first 2 constituents) are most important, the others occurring in small quantities, being objectionable for flavoring and removed by rectification with steam. *Tests:* 1. Distil oil 25 cc., collect the first 1 cc. and carefully superimpose it on 5 cc. of mercuric chloride T. S.—no white film at zone of contact in 1 minute (abs. of dimethyl sulphide, found in non-rectified peppermint oils). Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, ♏j–5 (.06–.3 cc.).

Adulterations.—Oil of erigeron, castor oil, oil of turpentine, oil of copaiba, oil of camphor, oil of sassafras, alcohol; the first, second, and third prevent its solubility in equal volume of 80 p. c. alcohol; the fourth gives buttery mass with sulphuric acid; oils of turpentine, camphor, and sassafras each render its action with iodine more violent, the two latter being red with nitric acid; dementholized oil (lower sp. gr.).

Menthol. **Menthol,** $C_{10}H_{19}OH$, *U.S.P.*—(Syn., Pipmenthol, Peppermint Camphor; Fr. Alcool Mentholique, Menthol Gauche, Camphre de Menthe; Ger. Mentholum, Pfefferminzkampfer, Mentha-kampfer.) This is a secondary alcohol (stearoptene), obtained from oil of peppermint or other mint oils (Japanese and Chinese oil of peppermint—*M. arven'sis* var. *piperas'cens*, *M. canaden'sis* var. *glabra'ta*). It is obtained by subjecting the volatile oil simply to refrigeration at —22.2° C. (—8° F.), by means of ice and salt; when solidified the temperature is allowed to rise gradually, the liquid portion poured off from time to time, and the crystals deprived of oil by expression; may purify by recrystallization. It is in colorless, acicular crystals, strong peppermint-like odor and taste, with a sensation of warmth followed by cold upon drawing air into the mouth; soluble in alcohol, chloroform, ether, petroleum benzin, liquid petrolatum, fixed or volatile oils, glacial acetic acid, slightly in water; alcoholic solution neutral, levorotatory; melts at 43° C. (110° F.); triturated with an equal weight of either camphor, phenol, thymol, or chloral hydrate—mixture becomes liquid; distilled with P_2O_5 yields menthene, $C_{10}H_{18}$, a colorless liquid of pleasant odor. *Tests:* 1. Heat 2 Gm. in open dish—gradually volatilizes with residue .05 Gm. (abs. of wax, paraffin, inorganic substances). 2. Few crystals dissolved in glacial acetic acid 1 cc., + sulphuric acid 3 drops and nitric acid 1 drop—not green (abs. of thymol). *Impurities:* Wax, paraffin, thymol, magnesium sulphate, inorganic substances. Should be kept cool, in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.).

Preparations.—Leaves and tops: 1. *Spiritus Menthæ Piperitæ.* Spirit of Peppermint. (Syn., Sp. Menth. Pip., Essence of Peppermint; Fr. Alcoolat (Essence) de Menthe poivrée; Ger. (Englische) Pfefferminz (-essenz)-spiritus.)

Manufacture: Macerate for 1 hour peppermint leaves 1 Gm. in 50 cc. of water, strongly express; mix oil of peppermint 10 cc. in alcohol 80 cc., add macerated leaves, and alcohol q. s. 100 cc., macerate mix-

ture for 6 hours, frequently shaking, filter. Should be kept in amber-colored bottles. Dose, ♏x–30 (.6–2 cc.).

Preps.: 1. *Elixir Catharticum Compositum, N.F.*, 1.4 p. c. 2. *Liquor Phosphori, N.F.*, ½ p. c. 3. *Mistura Opii et Rhei Composita, N.F.*, 20 p. c. 4. *Mistura Rhei Alkalina, N.F.*, ⅘ p. c. 5. *Mistura Rhei Composita, N.F.*, 3.5 p. c. 6. *Syrupus Ficus Compositus, N.F.*, $\frac{3}{10}$ p. c.

Oil: 1. *Aqua Menthæ Piperitæ.* Peppermint Water. (Syn., Aq. Menth. Pip.; Fr. Eau de Menthe poivrée; Ger. Pfefferminzwasser.)

Manufacture: ⅕ p. c. Similar to Aquæ Menthæ Viridis, page 523. Dose, ℥ss–1 (15–30 cc.).

2. *Spiritus Menthæ Piperitæ*, 10 p. c. 3. *Acetum Aromaticum, N.F.*, $\frac{1}{20}$ p. c. 4. *Cataplasma Kaolini, N.F.*, $\frac{1}{20}$ p. c. 5. *Elixir Euphorbiæ Compositum, N.F.*, $\frac{1}{10}$ p. c. 6. *Gargarisma Guaiaci Compositum, N.F.*, ⅕ p. c. 7. *Lavatio Ori, N.F.*, ½ p. c. 8. *Linimentum Opii Compositum, N.F.*, 2.5 p. c. 9. *Mistura Carminativa, N.F.*, $\frac{1}{20}$ p. c. 10. *Mistura Chloroformi et Morphinæ Composita, N.F.*, ⅕ p. c. 11. *Oleum Hyoscyami Compositum, N.F.*, ⅕ p. c. 12. *Pilulæ Catharticæ Vegetabiles, N.F.*, ⅛ ♏. 13. *Pilulæ Rhei Compositæ, N.F.*, $\frac{1}{13}$ ♏. 14. *Tabellæ Sodii Bicarbonatis, N.F.*, $\frac{1}{20}$ ♏. Menthol: 1. *Menthol Camphoratum, N.F.*, 47.5 p. c., + camphor 47.5, alcohol 5. 2. *Inunctum Mentholis, N.F.*, 5 p. c., + hydrous wool fat 95. 3. *Inunctum Mentholis Compositum, N.F.*, 5 p. c., + methyl salicylate 10, hydrous wool fat 85. 4. *Nebula Mentholis, N.F.*, 2 p. c., + light liquid petrolatum q. s. 100. 5. *Nebula Mentholis Composita, N.F.*, 1 p. c., + camphor 1, methyl salicylate ½, eucalyptol ⅕, oil of cinnamon ⅕, light liquid petrolatum q. s. 100. 6. *Petroxolinum Mentholis, N.F.*, 10 p. c. 7. *Dentifricium, N.F.*, ⅙ p. c. 8. *Dentilinimentum Aconiti Compositum, N.F.*, 36 p. c. 9. *Dentilinimentum Aconiti et Iodi Compositum, N.F.*, 2⅕ p. c. 10. *Linimentum Sinapis Compositum, N.F.*, 2 p. c. 11. *Liquor Antisepticus, N.F.*, $\frac{1}{10}$ p. c. 12. *Liquor Pepsini Antisepticus, N.F.*, $\frac{1}{20}$ p. c. 13. *Nebula Aromatica, N.F.*, ⅕ p. c. 14. *Pulvis Antisepticus, N.F.*, $\frac{1}{10}$ p. c.

Unoff. Preps.: Leaves and Tops: *Fluidextract*, ℥j–2 (4–8 cc.). *Infusion*, 5 p. c., ℥j-2 (30–60 cc.). *Syrup*, ℥j–4 (4–15 cc.). *Troches* (each contains oil $\frac{1}{7}$ ♏; .009 cc.). Menthol: *Plaster* (Br.), 15 p. c., + yellow wax 10, rosin 75.

Properties.—Carminative, stimulant, nervine, antispasmodic.

Uses.—Spasmodic stomach and bowel pains, flatulency, nausea, cholera morbus, diarrhea, dysentery, colic, dysmenorrhea, nervous headache, hiccough, heart palpitation, vomiting, as a flavoring agent; externally the oil and menthol for rheumatism, neuralgia, toothache, antibacterial.

Allied Plant:

1. *Collinso'nia canaden'sis, Stone-root, Horse-balm.*—N. America. Rhizome 10 Cm. (4′) long, branches short, knotty, white inside, inodorous, taste bitter, nauseous; contains volatile oil, resin. Diaphoretic, diuretic, tonic, astringent, irritant.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Myrtaceæ:								
1. Eucalyptus. 2. Eucalyptus.	Eucalyptus globulus.	The dried scythe-shaped leaf.	Australia.	Volatile oil, tannin, cerylic alcohol, eucalyptic acid, 3 resins.	Fluidextract, oil, eucalyptol.	Antiperiodic, stimulant, astringent, antiseptic, diaphoretic.	Intermittents, malaria, urinary, pulmonary troubles, bronchitis, hemorrhages, gleet, ulcers.	Grains. 15–60 (1–4 Gm.).
Umbelliferæ:								
1. Oleum Coriandri. 2. Oil of Coriander.	Coriandrum sativum.	The volatile oil from dried ripe fruit.	C. Asia, S. Europe.	*Oil:* *d*-pinene, geraniol, linalool.	.....	Aromatic, carminative, stimulant, stomachic.	Indigestion, flatulence, flavoring, rheumatism.	Minims. 2–5 (.13–.3 cc.).
1. Carum. 2. Caraway.	Carum Carvi (Carui).	The dried ripe fruit.	C. and W. Asia.	Volatile oil, fixed oil, resin, sugar, gum, tannin.	Tr. card. co., *Oil.*	Stimulant, carminative, diuretic, stomachic.	Colic, flatulence, flavoring, toothache.	Grains. 10–30 (.6–2 Gm.).
1. Oleum Anisi. 2. Oil of Anise.	Pimpinella Anisum, Illicium verum.	The volatile oil from dried ripe fruits.	W. Asia, S.E. Europe.	Anethol, *d*-pinene *d*-phellandrene, safrol.	*Oil:* Aq., spt., spt. aurant. co., syr. sars. co., fldext. cas. sag. ar., tr. opii camph.	Stimulant, carminative, stomachic, aromatic.	Colic, flatulence, bronchitis, catarrhs, flavoring.	Minims. 2–5 (.13–.3 cc.).
1. Oleum Fœniculi. 2. Oil of Fennel.	Fœniculum vulgare.	The volatile oil from dried ripe fruit.	S. Europe, W. Asia.	Anethol, pinene, phellandrene, dipentine.	*Oil:* Aqua, pulv. glycyr. co.	Carminative, stimulant, galactagogue.	Nausea, colic, amenorrhea, flatulence, increases secretions.	2–5 (.13–.3 cc.).
1. Asafœtida. 2. Asafetida.	Ferula: Asafœtida, fœtida.	The gum-resin.	Persia, Turkestan.	Gum, resin, vol. oil, vanillin, ferulic acid, asaresino-tannol.	Emulsion, pill, tinct.	Stimulant, antispasmodic, laxative, emmenagogue.	Hysteria, spasms, asthma, catarrhs, chorea, consumption, flatulence.	Grains. 3–10 (.2–.6 Gm.).
Ericaceæ:								
1. Methylis Salicylas. 2. Methyl Salicylate.	Gaultheria procumbens, Betula lenta.	An ester (compd. ether).	N. America.	$CH_3C_7H_5O_3$.	Emul. ol. morrh., fldext. cas. sag. ar., syr. sars. co.	Antiseptic, analgesic, carminative, stimulant, flavoring.	Rheumatism, migraine, sciatica, lumbago.	Minims. 1–10 (.06–.6 cc.).
1. Uva Ursi. 2. Uva Ursi.	Arctostaphylos Uva-ursi.	The dried leaves (leaf).	Europe, Asia, N. America.	Tannin, gallic acid, arbutin, ericolin, urson.	Fluidextract.	Astringent, diuretic, tonic, nephritic.	Cystitis, gravel, gleet, menorrhagia, bronchitis, diarrhea.	Grains. 15–60 (1–4 Gm.).
Styraceæ:								
1. Benzoinum. 2. Benzoin.	Styrax Benzoin, +.	The balsamic resin.	Sumatra, Java, Borneo, Siam.	Benzoic and cinnamic acids, resin, volatile oil, vanillin.	Benzoinated lard, tinct., tinct. benz. co., benzoic acid.	Stimulant, expectorant, antiseptic, diuretic.	Laryngitis, diarrhea, wounds, coryza, ulcers.	5–30 (.3–2 Gm.).
Oleaceæ:								
1. Manna. 2. Manna.	Fraxinus Ornus.	The dried (saccharine) exudation.	Mediterranean Basin.	Mannite, glucose, sucrose, resin, fraxin, mucilage.	.....	Laxative, demulcent, expectorant, cholagogue.	Piles, urinary irritation, to evacuate bowels of children, etc.	60–480 (4–30 Gm.).

1. Oleum Olivæ. 2. Olive Oil.	Olea europæa.	The fixed oil.	Asia, S. Europe.	Olein, linolein, palmitin, arachin, phytosterin.	Emp. plumb. oleat., soap: soap lin., ext. colocy. co., pil. aloes, pil. asaf.	Nutrient, laxative, demulcent, protective.	Constipation of infants, gall-stones, bruises, sprains, wounds, ascarides, lubrication.	Minims. 60–480 (4–30 cc.).
Loganiaceæ: 1. Nux Vomica. 2. Nux Vomica.	Strychnos Nux-vomica.	The dried ripe seed.	India, E. India Islands.	Strychnine, brucine, igasurine, igasuric acid, loganin, fat.	Extract, tincture, strychnine: nitrate, sulphate.	Spinal nervine, tonic, poisonous.	Atonic dyspep., nervousness, anemia, paralysis, lead palsy, tetanus, chorea, epilepsy.	Grains. $\frac{1}{2}$–5 (.03–.3 Gm.).
Gentianaceæ: 1. Gentiana. 2. Gentian.	Gentiana lutea.	The dried rhizome and roots.	C. and S. Europe.	Gentiopicrin, gentiin, gentiogenin, gentienin, gentianose fixed oil, pectin, resin.	Tinct. gent. comp.	Tonic, bitter.	Increases digestion, amenorrhea, dyspepsia, intermittents.	5–30 (.3–2 Gm.).
Apocynaceæ: 1. Strophanthus. 2. Strophanthus.	Strophanthus: Kombé, hispidus.	The dried ripe seed.	Africa, Asia.	Strophanthin, choline, trigonelline, strophanthic acid, fixed oil.	Tincture.	Heart stimulant, diuretic.	Bright's disease, heart palpitation, endocarditis, asthma, dropsy.	$\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.).
Convolvulaceæ: 1. Jalapa. 2. Jalap.	Exogonium Jalapa.	The dried tuberous root.	E. Mexico.	Resin (jalapin and jalapurgin), starch, gum.	Comp. powder, resin, pil. hg. chlor. mit. co.	Hydragogue cathartic, diuretic.	Constipation, dropsy, fevers, inflammations, head affections.	5–20 (.3–1.3 Gm.).
1. Ipomœa. 2. Ipomea.	Ipomœa orizabensis.	The dried root.	Mexico.	Resin, starch, gum, tannin.	Resin, extract. colocyn. co.	Hydragogue, chologogue cathartic.	Dropsies, cerebral affections.	10–30 (.6–2 Gm.).
Hydrophyllaceæ: 1. Eriodictyon. 2. Eriodictyon.	Eriodictyon californicum.	The dried leaves (leaf).	California.	Volatile oil, resin, eriodictyol, phenol, triacontane, tannin.	Fluidextract.	Expectorant, bitter tonic, stimulant.	Bronchitis, asthma, to disguise quinine taste.	30–60 (2–4 Gm.).
Labiatæ: 1. Oleum Rosmarini. 2. Oil of Rosemary.	Rosmarinus officinalis.	The volatile oil.	S. Europe, Med. Basin.	Pinene, camphor, borneol, cineol.	Soap liniment, tinct. lavender comp.	Carminative, stimulant, diuretic, diaphoretic.	Colic, nervousness, menstrual derangements, rheumatism, sprains.	Minims. 1–5 (.06–.3 cc.).
1. Oleum Lavandulæ. 2. Oil of Lavender.	Lavandula spica.	The volatile oil.	S. Europe.	Terpene, $C_{10}H_{16}$. geraniol, linalool, $C_{10}H_{18}O$.	Spirit, comp. tinct., Fowler's sol., lin. sap. mol., sp. am. aro., ung. pb. ol.	Stimulant, carminative, nervine, errhine.	Gastralgia, nausea, headache, flatulence, perfumery.	1–5 (.06–.3 cc.).
1. Thymol. 2. Thymol.	Thymus vulgaris.	Phenolin volatile oil.	S. Europe.	$C_{10}H_{14}O$.	.....	Stimulant, tonic, emmenagogue, antispasmodic, antiseptic.	Chlorosis, rheumatism, neuralgia, bronchitis, diarrhea, gleet, vesical catarrh.	Grains. 1–5 (.06–.3 Gm.).
1. Mentha Viridis. 2. Spearmint.	Mentha spicata (viridis).	The dried leaves and tops.	Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit, *Oil:* water, spirit.	Carminative, stimulant, nervine.	Cholera infantum, culinary and confectionery purposes, perfume.	30–60 (2–4 Gm.).
1. Mentha Piperita. 2. Peppermint.	Mentha piperita.	The dried leaves and tops.	Asia, Europe, N. America.	Volatile oil, resin, tannin, gum.	Spirit, *Oil:* water, spirit.	Carminative, stimulant, nervine, antispasmodic.	Flatulence, colic, nausea, headache, dysmenorrhea, rheumatism, toothache.	15–60 (1–4 Gm.).

61. SOLANACEÆ. Nightshade (Potato) Family.

Sol-a-na'se-e. L. *Solan-um* + aceæ, fr. *sol*, the sun—*i. e.*, plants dislike sunlight, grow best in the shade, hence nightshade; or *solor*, to comfort—*i. e.*, the plants, soothing, narcotic effect; or *sulanum*, *sus*, hog—*i. e.*, plants act as cure for swine disease. Herbs, rarely shrubs, trees. Distinguished by having colorless juice, mydriatic alkaloids, alternate leaves; flowers regular, 5's, isomerous, plicate border; ovary superior, 2-celled, ovules many, embryo straight or coiled in fleshy albumin; fruit, capsule or berry, some edible. Differs from Convolvulaceæ by not twining and in having many seeds; universal, tropics; narcotic, stimulant, bitter, tonic, poisonous.

Genera: **1. Capsicum. 2. Atropa. 3. Hyoscyamus. 4. Datura.**

CAPSICUM. CAPSICUM, *U.S.P.*

Capsicum frutescens, *Linné.*

The dried ripe fruit, grown in Africa, with not more than 3 p. c. stems, calyxes, nor 1 p. c. other foreign organic matter, yielding not less than 12 p. c. non-volatile, ether-soluble extractive, nor more than 1.25 p. c. acid-insoluble ash.

Habitat. S. and C. America (Cayenne in Guiana), introduced into E. Indies, Java (by Portuguese), also into Africa; cultivated in United States, also in tropics.

Syn. Capsic., Cayenne Pepper, African Chillies, Spanish, Red, Bird, Garden, Cockspur, Pod, Chilly, Zanzibar, Goat's, Guinea, American Cayenne or African Cayenne Pepper, Chillies; Piper Hispanicum; Br. Capsici Fructus (C. minimum); Fr. Capsique, Piment (rouge) des jardins, Poivre de Cayenne-, Guinée or d'Inde; Ger. Fructus Capsici, Spanischer Pfeffer, Schlotenpfeffer.

Cap'si-cum. L. *capsa*, a box—*i. e.*, shape of the fruit; or from Gr. κάπτω, to bite—*i. e.*, from its hot, pungent properties.

Fru-tes'cens. L. *frutex*, shrub, bush—*i. e.*, somewhat shrub-like in habit and appearance.

PLANT.—Small, spreading shrub, .6–1 M. (2–3°) high; stem much branched; leaves alternate, 5–7.5 Cm. (2–3′) long, entire, glabrous; flowers 2–3 together in the bifurcations, greenish-yellow, July–Aug.; ovary 2-celled, many ovules. FRUIT, oblong, conical, usually compressed, 10–25 Mm. ($\frac{2}{5}$–1′) long, 4–8 Mm. ($\frac{1}{6}$–$\frac{1}{3}$′) broad, 2–3-locular, dissepiments united to placenta at base of fruit, brownish-red, orange (pericarp), glabrous, dull, thin, shriveled, striate, membranous, 6–21 yellowish flattened seed, pointed micropyle; odor characteristic, sternutatory; taste intensely pungent. POWDER, yellowish-brown—thin-walled parenchyma with oil globules, epidermal cells of pericarp and seed-coat and stone cells of endocarp. *Tests:* 1. Fragments of pericarp with outer epidermis consisting of irregular cells not in rows but with strongly beaded radial walls and a hypodermis of angular cells with thickened, beaded walls—pres. of Japanese or East Indian capsicum.

2. Macerate 1 Gm. + alcohol 50 cc., 4 days, in a stoppered flask; add to .1 cc. clear supernatant liquid 140 cc. distilled water containing 10 p. c. of sucrose; 5 cc. of this dilution swallowed—at once the pungent sensation of capsicum in the throat of two out of three individuals. *Solvents:* alcohol; ether, hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

ADULTERATIONS.—FRUIT: Fruits of allied species; POWDER: Red oxide of lead, colored sawdust, bran, etc.—the former recognized by adding diluted nitric acid to dissolve lead and precipitating same with sodium sulphate—the two latter by the microscope; corn meal, starch (iodine test), ash 15–18.4 p. c.

Commercial.—Plant largely cultivated in our country to supply demand. Fruit is plucked, exposed to sun until dried, then packed in suitable shape for market; much imported from India, Africa—Liberia, Zanzibar, Natal, Bombay, Penang, Pegu, Cayenne, etc.

FIG. 348.—*Capsicum frutescens.*

CONSTITUENTS.—Capsaicin (capsacutin, capsicin) .02 p. c., Capsicine, Volatile oil, fixed oil, fatty acids (oleic, stearic, palmitic), resin, red coloring matter (cholesterin ester of the fatty acids), ash 7 p. c., of which 1 p. c. is insoluble in hydrochloric acid.

Capsaicin, $C_{18}H_{28}O_3N$.—Considered the chief active constituent—identical with capsacutin, resides mostly in the pericarp and placenta, and is obtained by adding diluted caustic alkali to the petroleum extract, passing CO_2 through this alkaline solution, when it crystallizes out in colorless form. It is soluble in alcohol, ether, benzene, fixed oils, and its vapors are intensely acrid and irritating. It has also been obtained as an oleoresin (capsicin, capsicol), amorphous resin-like acid, to which the red coloring matter persistently adheres. Dose, gr. $\frac{1}{10}$–$\frac{1}{4}$ (.006–.016 Gm.).

SOLANACEÆ

Capsicine.—This occurs in small quantity; it is a volatile alkaloid, having odor of coniine devoid of pungency—and is an oily liquid, not existing in the unripe fruit, but results from decomposition processes in ripening.

Volatile Oil.—Obtained by distillation and gives to the fruit its odor.

PREPARATIONS.—1. *Oleoresina Capsici.* Oleoresin of Capsicum. (Syn., Oleores. Capsic.; Fr. Oleoresine (Extrait éthéré) de Capsique; Ger. Spanisch-pfeffer-oelharz.)

Manufacture: Percolate slowly, in a covered glass percolator, 100 Gm. with ether, added in successive portions, until 160 cc. of percolate obtained, reclaim most of the ether on water-bath, transfer residue to a dish, allow remaining ether to evaporate spontaneously in a warm place, remote from a naked flame, pour off liquid portion, transfer remainder to a glass funnel with pledget of cotton; when separated fatty matter (which is to be rejected) has drained, mix liquid portions; yield 12–15 p. c. Should be kept in well-stoppered bottles. Dose, $\mathfrak{m}\frac{1}{4}$–1 (.016–.06 cc.).

FIG. 349.—Capsicum fruit: magnified.

FIG. 350. — Capsicum fruit: cross-section, magnified.

FIG. 351. — *Capsicum annuum:* fresh fruit one-half natural size.

Prep.: 1. *Emplastrum Capsici.* Capsicum Plaster. (Syn., Emp. Capsic.; Fr. Sparadra(pum) Capsici (de Capsique); Ger. Capsicumpflaster.)

Manufacture: Apply oleoresin of capsicum to the surface of rubber plaster so as to form a thin, even coating, leaving a margin around the edges; each 15 □ Cm. of spread plaster contains .25 Gm. of oleoresin of capsicum—requiring about 6 ℳ; .4 cc.

2. *Tinctura Capsici.* Tincture of Capsicum. (Syn., Tr. Capsic.; Fr. Teinture de Piment des jardins; Ger. Spanischpfeffertinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: 95 p. c. alcohol. Dose, ℳx–60 (.6–4 cc.).

Preps.: 1. *Mistura Chloroformi et Morphinæ Composita, N.F.,* 2.5 p. c. 2. *Mistura Opii et Chloroformi Composita, N.F.,* 10 p. c. 3. *Mistura Opii et Rhei Composita, N.F.,* 10 p. c.

3. *Pulvis Aromaticus Rubefaciens, N.F.*, 20 p. c. 4. *Pulvis Myricæ Compositus, N.F.*, 5 p. c. 5. *Tinctura Capsici et Myrrhæ, N.F.*, 3 p. c., + myrrh 12, 90 p. c. alcohol q. s. Dose, ♏x–60 (.6–4 cc.).

Unoff. Preps.: Extract, gr. ½–2 (.03–.13 Gm.). *Fluidextract* (alcohol), ♏j–5 (.06–.3 cc.). *Infusion*, 5 p. c., ℥ij–4 (8–15 cc.). *Ointment* (Br.), 20 p. c.

Properties.—Stimulant, stomachic, rubefacient, condiment, diaphoretic; stimulates flow from salivary, gastric, and intestinal glands, also the stomach walls and heart. Long continuance may produce—chronic gastritis, abdominal pain; large quantity—acute gastritis, renal inflammation, strangury.

Uses.—Indigestion, dyspepsia, atonic gout, alcoholism, delirium tremens, intermittents; flatulent colic, low fevers, cholera, menorrhagia, seasickness, tonsillitis, scarlet fever, diphtheria, hemorrhoids; externally—lumbago, rheumatism, neuralgia, chilblains, relaxed uvula. Was known to the Romans, and used in E. Indies from time immemorial.

Allied Plant:

1. *Capsicum an'nuum* (*lon'gum*).—Fruit, U.S.P. 1820–1860; Fruit 5–10 Cm. (2–4′) long, 2.5–4 Cm. (1–1⅗′) thick, oblong, conical, sometimes curved or subglobular, yellow or red, brown when dry. Known in England as pod pepper, but often sold as *chillies* or *capsicums*, and is the kind recognized by the Ger. Phar. *C. fastigia'tum.*—Fruit, once official, and like that which is now official, 8–12 Mm. (⅓–½′) long, 3–4 Mm. (⅛–⅙′) thick. *C. cerasifor'me*, fruit resembles a cherry. All three sometimes used for purposes similar to official.

BELLADONNA. BELLADONNA.

1. Belladonnæ Folia. Belladonna Leaves, *U.S.P.*
2. Belladonnæ Radix. Belladonna Root, *U.S.P.*

Atropa Belladonna, *Linné.*

1. The dried leaves and tops with not more than 3 p. c. stems over 10 Mm. (⅖′) thick, yielding not less than .3 p. c. alkaloids nor more than 3 p. c. acid-insoluble ash. 2. The dried root with not more than 10 p. c. stem-bases and woody crowns, yielding not less than .45 p. c. alkaloids nor more than 4 p. c. acid-insoluble ash.

Habitat. C. and S. Europe, Asia Minor, Algeria, in waste ground, mountainous woods; cultivated in Germany, France, England, N. America.

Syn. Deadly or Sleeping Nightshade, Death's Herb, Banewort, Mekilwort, (Poison) Black Cherry, Doft- (Dway-) berry, Dwale; Bellad. Fol., Deadly Nightshade Leaves; Bellad. Rad., Deadly Nightshade Root; Fr. Belladone, Morelle furieuse, Feuilles de Belladone, Racine de Belladone; Ger. Toll-, Wolf-Kirsche, Tollkraut, Belladonna, Tollkirschenblätter, Tollkirschenwurzel.

SOLANACEÆ

At'ro-pa. L. fr. Gr. "Ατροπος = ἀ, priv., + τρέπειν, to turn—not to turn, to be inflexible. One of the mythological fates, whose office it was to cut the thread of life—*i. e.*, with this poisonous fruit or plant the functions of office could easily be performed.

Bel-la-don'na. L. *bella*, beautiful, + *donna*, a lady—*i. e.*, the berries were used by the Italian ladies as a cosmetic, and to dilate their eye pupils, thus giving them a strikingly handsome appearance.

FIG. 352.—*Atropa Belladonna:* branch, fruit, seed, and section of seed, the last two magnified.

PLANT.—Bushy perennial, 1–1.5 M. (3–5°) high; stems 12–25 Mm. ($\frac{1}{2}$–1′) thick, purplish, longitudinally wrinkled, older parts smooth, usually hollow, younger parts flattened, finely hairy; flowers 2.5 Cm. (1′) long, yellowish-purple, campanulate, 5's; fruit dark green berry, size of cherry, subtended by dark green calyx; seed, small numerous. LEAVES, broadly ovate, 5–20 Cm. (2–8′) long, 4–12 Cm. ($1\frac{3}{4}$–5′) broad, usually matted together, crumpled or broken, but pliable when soaked in water or steamed, brownish-green, acute, entire, narrowed into the petiole, few hairs, numerous whitish dots (crystal-cells) visible with lens; stems more or less hollow and flattened; flowers with campanulate corolla, yellowish-purple; fruit nearly globular, green, brown, numerous reniform seed; odor slight, somewhat tobacco-like when moistened; taste bitter, acrid. POWDER, brownish-green—microcrystals, crystal-cells, tracheæ, bast- and wood-fibers of stem, hairs and pollen grains; no calcium oxalate in rosette aggregates (abs. of stramonium leaves); no raphides (abs. of phytolacca leaves). Dose, gr. $\frac{1}{2}$–3 (.03–.2 Gm.). ROOT, cylindrical or tapering pieces 10–30 Cm. (4–12′) long, .5–4 Cm. ($\frac{1}{5}$–$1\frac{3}{5}$′) thick, often split longitudinally or broken transversely, grayish-brown, wrinkled, soft periderm frequently abraded; fracture short, mealy and emitting a puff of dust (starch grains); internally whitish,

with distinct cambium zone, yellowish wood wedges; nearly odorless (dry), characteristic (moist), taste sweetish, bitter, acrid. POWDER, light brown—numerous starch grains, excentric hilum, microcrystals, tracheæ, few wood-fibers and bast-fibers (stem)—old fibrous roots contain excess of lignified tissue. *Solvents:* 75–83 p. c. alcohol; hot water partially. Dose, gr. ½–2 (.03–.13 Gm.).

ADULTERATIONS.—LEAVES: Digitalis, hyoscyamus, stramonium, ailanthus—long tapering base; verbascum—hairy, more or less lobed, differently colored and veined; black nightshade (*Solanum ni'grum*)—

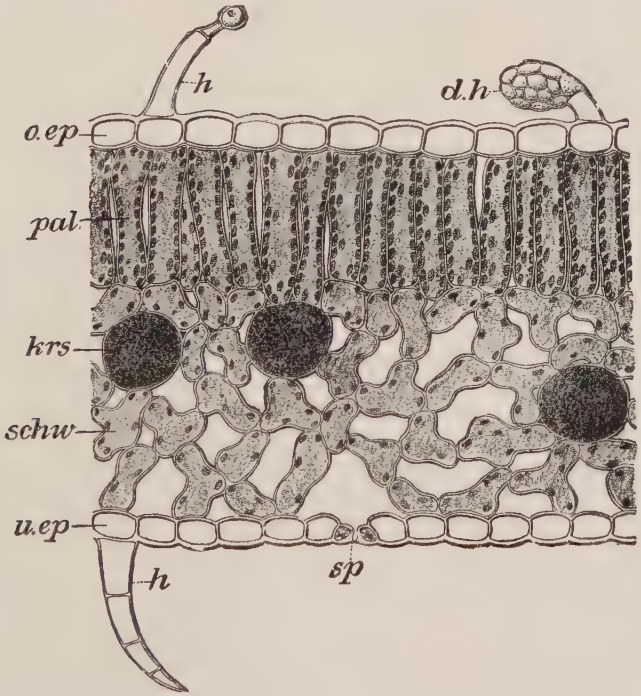


FIG. 353.—Belladonna leaf cross-section: *o.ep.* upper epidermis with a glandular hair having long stem with little head (*h*), and a very short-stemmed glandular hair with large many-celled head (*d.h*); *pal*, palisade tissue; *krs*, sand-crystal cell; *schw*, spongy parenchyma; *u.ep*, lower epidermis with stomata (*sp*), and a single multicellular hair (*h*), magnified 175 diam.

leaves smaller, dentate; scopola (*Scopola carniolica*)—leaves oblong-ovate, without stomata on upper surface, often 15–20 p. c.; poke root (*Phytolacca decandra*)—leaves detected by the more angular epidermal cells and calcium oxalate needles; ROOT: Rare—roots of allied species, rhizome of scopola—darker, tough, flexible, numerous stem-scars, transverse root-scars, thin bark, without short snapping fracture and puff of dust; medicago (*Medica'go sati'va*) stem-bases solid (not hollow), tough, flexible, thinner bark, without snapping fracture and puff of dust; althea—fracture tough; poke root—many needles of calcium

oxalate (in powdered scrapings). Roots of inula, spikenard, and parsley have similar appearance.

Commercial.—Plant prefers limestone soil and grows in stony, shady, bushy places, along walls, amid rubbish. Of the wild and cultivated all parts practically are active alike, but the English is considered superior to the German. Leaves and roots should be collected when strongest—from plants 2–4 years old, the former in flowering, June–July, the latter in autumn or early spring; if younger the root fracture is horny, resinous, if older, woody, splintery, both indicating deficiency in alkaloids, which reside chiefly in the bark; large pieces often are split to avoid damage in drying, while hyoscyamine, under various conditions in making the preparations, is converted into atropine.

FIG. 354. — Belladonna root: transverse section, magnified 3 diam.

CONSTITUENTS.—Atropine, .2–.6 p. c., Belladonnine, Hyoscyamine, scopolamine (hyoscine), atropamine, atrosin, malic acid, starch (autumn), sugar (spring); leaves have, in addition: chlorophyll, choline (bilineurine), albumin, mucilage, wax, asparagin, chrysatropic acid (scopoletin), succinic acid, nitrates, ash 7 (root)–20 (leaves) p. c. (Ca, Mg. K, carbonates).

Atropina, Atropine, $C_{17}H_{23}O_3N$, *U.S.P.*—(Syn., Atrop., Atropia; Fr. Atropine; Ger. Atropinum, Atropin.) This alkaloid in commerce always contains a little hyoscyamine, which is separated with difficulty, as they are extracted together by agitating an alcoholic tincture of the root with slaked lime, in order to decompose the natural salt and liberate the alkaloid, which remains in solution; acidify filtrate with diluted sulphuric acid, concentrate to remove alcohol, fat, resin, shake with chloroform to remove chlorophyll, and to filtrate add potassium carbonate in excess; purify by dissolving washed precipitate (atropine) in alcohol, add water until slightly turbid, crystallize. It is in white rhombic prisms, odorless, bitter, acrid, soluble in water (455), hot water (90), alcohol (2), glycerin (27), chloroform (1), ether (25), aqueous solution alkaline, melts at 115° C. (239° F.); forms numerous salts (hydrobromide, hydrochloride, nitrate, sulphate, etc.). *Tests:* 1. Evaporate .01 Gm. + few drops of nitric acid to dryness—yellow residue, which upon cooling, + few drops of alcoholic potassium hydroxide T. S., + fragment of potassium hydroxide—intense violet, for atropine, hyoscyamine, hyoscine (abs. of strychnine, which masks reaction). 2. Solution in dilute hydrochloric acid (1 in 50) + gold chloride T. S.—lusterless precipitate (dist. from hyoscyamine—lustrous precipitate); incinerate .1 Gm.—ash negligible. 3. Heated with barium hydroxide becomes hydrolized into tropic acid, $C_9H_{10}O_3$, and tropine, $C_8H_{15}ON$,—tropine tropate—and by heating these together synthetic atropine results; other tropines (alkaloids, compound esters) have been formed with various organic acids, as tropine mandelate, which

yields homatropine. *Impurities:* Foreign alkaloids (platinic chloride T. S.—precipitate), apoatropine, belladonnine (ammonia water—turbidity), hyoscyamine, readily carbonizable substances (sulphuric or nitric acid—yellow, brown). Exercise great caution in tasting, using very dilute solution. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Atropinæ Sulphas, Atropine Sulphate, $(C_{17}H_{23}O_3N)_2.H_2SO_4.H_2O$, *U.S.P.*—(Syn., Atrop. Sulph., Sulphate of Atropia; Fr. Sulfate d'Atropine; Ger. Atropinum sulfuricum, Atropinsulfat, Schwefelsaures Atropin.) Obtained by dissolving atropine mixed with water by means of diluted sulphuric acid, neutralizing, evaporating, or dissolve in alcohol, neutralize with sulphuric acid, evaporate; as such is accompanied usually by small amount of hyoscyamine sulphate, from which it cannot readily be separated. It is a white crystalline powder, efflorescent in dry air, odorless, soluble in water (.4), alcohol (5), boiling alcohol (2.5), glycerin (2.5), chloroform (420), ether (3000); aqueous solution neutral; melts at 190° C. (374° F.). Exercise great caution in tasting, using very dilute solution. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.005–.001 Gm.).

Homatropinæ Hydrobromidum, Homatropine Hydrobromide, $C_{16}H_{21}O_3N.HBr$, *U.S.P.*—(Syn., Homatrop. Hydrobr., Homatropine Bromide; Fr. Bromhydrate d'Homatropine; Ger. Homatropinum hydrobromicum, Bromwasserstoffsaures Homatropin (Oxytoluyltropein).) Obtained by the condensation of tropine and mandelic acid—heating tropine, $C_8H_{15}ON$, with mandelic acid (tropine mandelate) for several days on a water-bath, in the presence of dilute (12 p. c.) hydrochloric acid, adding ammonia water and extracting liberated alkaloid with chloroform, evaporating chloroformic solution, neutralizing with hydrobromic acid, crystallizing. It is in white crystals or a white, odorless, crystalline powder, soluble in water (6), alcohol (40), chloroform (420), hot alcohol (12); insoluble in ether; aqueous solution (1 in 20) neutral; melts at 212° C. (414° F.) with partial decomposition. *Tests:* 1. Shake 1 cc. of aqueous solution (1 in 10) + chloroform 2 cc., + few drops of chlorine T. S.—chloroform becomes brownish. 2. Add to aqueous solution iodine T. S.—brown precipitate; silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid; incinerate .1 Gm.—ash negligible. *Impurities:* Atropine, hyoscyamine, scopolamine (hyoscine), with tannic acid T. S. or platinic chloride T. S.—no precipitate, but with other alkaloids—precipitate. Exercise great caution in tasting, using very dilute solution. Should be kept dark, in well-closed containers. Superior to atropine in being less toxic, in decreasing instead of increasing heart-rate and blood-pressure, and in the effects passing off in one-fourth the time—1–2 days; inferior to it where lasting mydriasis is desired. Used to correct anomalies of refraction, in 1–2 p. c. solutions. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

Belladonnine, $C_{17}H_{23}O_4N$.—**Oxyatropine** and **Atropamine (Apoatropine, Aposterpine),** $C_{17}H_{21}O_2N$.—All these may be one and the same; yellow powder decomposed very easily by mineral acids.

SOLANACEÆ

Hyoscyamine (daturine, duboisine of other plants).—This has the same formula as atropine and scopolamine (hysocine), but is more soluble in water and diluted alcohol, and forms gold salts with a different fusing-point; is converted into atropine by alkalies in alcoholic solution.

Atrosin (*β-methyl æsculetin*).—This is the red coloring matter, fluorescent.

Malic Acid.—This holds the alkaloids in combination.

The young roots contain only hyoscyamine, those of 8–10 years old also atropine: alkaloids are mostly in the bark, hence large woody roots should be rejected.

PREPARATIONS.—I. LEAVES: 1. *Extractum Belladonnæ.* Extract of Belladonna. (Syn., Ext. Bellad., Extractum Belladonnæ Foliorum (Alcoholicum); Fr. Extrait de Belladone; Ger. Belladonnaextrakt (Spirituöses), Tollkirschenextrakt.)

Manufacture: PILULAR, macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted (300 cc.), reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain 1.25 p. c. of total alkaloids, mix thoroughly. POWDERED, macerate, percolate 100 Gm. with alcohol, reserve first 100 cc. and continue until exhausted (100 cc.); reclaim alcohol from second percolate until residue in still is 10 cc., to which add first reserve and distil until residue of syrupy consistence; transfer to a dish, rinse still with little warm alcohol, which add to dish and evaporate at 70° C. (158° F.) to soft extract, stirring frequently, add dried starch 5 Gm., heat, with stirring, until nearly dry, incorporate thoroughly dried starch, 2 Gm., expose to current of warm air until dry, pulverize; after assay add enough dried starch for extract to contain 1.25 p. c. of total alkaloids, mix thoroughly, pass through fine sieve; contains 1.18–1.32—1.25 p. c. of the alkaloids; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.).

Preps.: 1. *Emplastrum Belladonnæ.* Belladonna Plaster. (Syn., Emp. Bellad.; Fr. Emplâtre d'Extrait de Belladone; Ger. Belladonnapflaster.)

Manufacture: Melt adhesive plaster 70 Gm., add extract of belladonna 30 Gm., softened by heat, stir until homogeneous, cool; contains 30 p. c. of extract of belladonna, yielding .25–.30 p. c. of total alkaloids.

2. *Unguentum Belladonnæ.* Belladonna Ointment. (Syn., Ung. Bellad.; Fr. Pommade Belladonée; Ger. Tollkirschensalbe.)

Manufacture: Triturate pilular extract of belladonna 10 Gm. with diluted alcohol 5 cc., until a smooth mixture, add yellow wax 5, wool fat 30, petrolatum 50, previously melted together, mix thoroughly.

3. *Pilulæ Aloini, Strychninæ et Belladonnæ, N.F.*, $\frac{1}{8}$ gr. 4. *Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, N.F.*, $\frac{1}{8}$ gr. 5. *Pilulæ Aloini Compositæ, N.F.*, $\frac{1}{4}$ gr. 6. *Pilulæ Aloes et Podophylli Compositæ, N.F.*, $\frac{1}{4}$ gr. 7. *Pilulæ Laxativæ Compositæ, N.F.*, $\frac{1}{8}$ gr.

2. *Fluidextractum Belladonnæ Foliorum.* Fluidextract of Belladonna Leaves. (Syn., Fldext. Bellad. Fol.; Fr. Extrait de Feuilles de Belladone; Ger. Belladonnablatterfluidextrakt, Tollkirschenblatterfluidextrakt.)

Manufacture: Similar to Fluidextractum Colchici, page 111; menstruum: alcohol 75 p. c.—reserve first 80 cc. in which dissolve soft extract, assay, and add enough menstruum for the 100 cc. to contain .27–.33—.3 Gm. of total alkaloids. Dose, ♏$\frac{1}{3}$–5 (.02–.3 cc.).

3. *Tinctura Belladonnæ.* Tincture of Belladonna. (Syn., Tr. Bellad., Tinctura Belladonnæ Foliorum; Br. Tinctura Belladonnæ; Fr. Teinture de Belladone; Ger. Belladonnatinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol—percolate 95 cc., assay, and add enough menstruum for the 100 cc. to contain .027–.033—.03 Gm. of total alkaloids. Dose, ♏j–30 (.06–2 cc.).

II. Root: 1. *Fluidextractum Belladonnæ Radicis.* Fluidextract of Belladonna Root. (Syn., Fldext. Bellad. Rad., Fluid Extract of Belladonna Root; Br. Extractum Belladonnæ Liquidum; Fr. Extrait fluide de Racine de Belladone; Ger. Tollkirschen(wurzel) fluidextrakt.)

Manufacture: Similar to Fluidextractum Colchici, page 111; menstruum: 83 p. c. alcohol; reserve first 80 cc., in which dissolve soft extract, assay, and add enough menstruum for the 100 cc. to contain .405–.495—.45 Gm. of total alkaloids. Dose, ♏j–5 (.06–.3 cc.).

Prep.: 1. *Linimentum Belladonnæ, N.F.*, 95 p. c., + camphor 5.

Unoff. Preps.: I. Leaves: *Extractum Belladonnæ Viride*—express juice, heat, strain, evaporate, add coloring matter strained out, gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Infusion*, 5 p. c., ℥j–3 (4–12 cc.). *Succus Belladonnæ*—expressed juice (3), and alcohol (1), ♏v–15 (.3–1 cc.). II. Root. *Abstract*, gr. $\frac{1}{10}$–1 (.006–.06 Gm.). *Extract*, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.). *Suppositoria Belladonnæ* (Br.), each contains $\frac{1}{60}$ gr. (.001 Gm.) of alkaloids. III. Atropine: *Lamellæ Atropinæ* (Br.), each $\frac{1}{5000}$ gr. (.000013 Gm.). *Lamellæ Homatropinæ* (Br.), each $\frac{1}{100}$ gr. (.0006 Gm.). *Oleate*, 2 p. c.; used externally. *Unguentum Atropinæ* (Br.) 2 p. c.

Properties.—Sedative, narcotic, diuretic, mydriatic, antispasmodic, anodyne. Like all medicines that act through nervous system, small doses, stimulate, large ones paralyze. Diminishes most secretions (salivary, mammary, skin, stomach, liver, pancreas, intestines) by paralyzing peripheral nerve-endings, increases peristalsis by paralyzing terminations of involuntary intestinal muscles; dilates pupil, increases pulse and urine by paralysis; often causes erythematous eruption.

Uses.—Lessens pain, rheumatism, gout, neuralgia, sciatica, cancer, pelvic derangements, encephalitis, meningitis, myelitis, erysipelas,

to check profuse sweating, serous diarrhea, urinary flow, ptyalism. Inflammation of lungs, iris, bladder, kidneys, breast, acute catarrh, sore throat, asthma, whooping-cough, spasms, constipation, spermatorrhea, prophylactic against scarlet fever. Locally in abscesses, carbuncles, skin diseases, scarlet fever rash, to check mammary secretion, relieve vomiting of pregnancy; smoke leaves with opium for phthisis. Atropine (hypodermic) is the sheet-anchor in poisoning by opium, physostigmine, and hydrocyanic acid.

Poisoning: Within 15 minutes have dryness of mouth, dry burning throat, dilated pupils, intense thirst which nothing allays, indistinct and double vision, giddiness, burning in stomach, nausea, difficult deglutition, hallucinations, delirium or fits of laughter, rambling talk, feeble and rapid pulse, cold extremities, coma, convulsions, death; sometimes face red and swollen, rash resembling scarlet fever, desquamation, inability to urinate. Give emetics or use pump, enemas, tannic acid, then morphine, physostigmine, or pilocarpine (hypodermic) for nervous disturbance; stimulants, brandy, caffeine, strychnine, artificial respiration, cold to head, warmth to feet, empty bladder. Children often eat the sweet fruit in excess, and should receive this treatment.

Incompatibles: Muscarine, physostigmine, pilocarpine, aconite, opium, tannin, caustic alkalies (evolve ammonia), quinine.

Synergists: Mydriatic drugs (hyoscyamus, stramonium, duboisia).

FIG. 355.—*Solanum Dulcamara.*

FIG. 356.—Dulcamara (Nat.).

FIG. 357. — Dulcamara: transverse section of a branch magnified 3 diam.

Allied Plants:

1. *Sola'num Dulcama'ra, Dulcamara, Bittersweet, N.F.*—The dried stem with not more than 2 p. c. of foreign organic matter; Europe, Asia (N. America). Climbing pubescent shrub, around dwellings, in thickets; leaves cordate, halberd-shaped, pubescent beneath; flowers

purple, whitish; fruit oval red berry, many-seeded. Stem woody at base, branching 3–4.5 M. (10–15°) high, collected when 1–2 years old, autumn or early spring, cut into short sections, 8 Mm. ($\frac{1}{3}'$) long, 5 Mm. ($\frac{1}{5}'$) thick, cylindrical, hollow, angular, striate, warty; bark thin, greenish-brown, glabrous, wood yellowish, in 1–2 concentric rings; odor slight; taste bitter, then sweet. Powder, greenish-yellow—tracheæ with pores, markings, wood-fibers, bast-fibers, cork cells, few hairs, starch grains, numerous microcrystals; solvents: diluted alcohol, water partially; contains dulcamarin (picroglycion, dulcarin) .4 p. c., solanine, resin, gum, wax, benzoic acid, starch, calcium lactate. Narcotic, diuretic, diaphoretic, alterative, deobstruent; large doses produce vomiting, faintness, vertigo, convulsive muscular movements, dryness and constriction of the throat, thirst, diarrhea, weakened heart action, paralysis. Cutaneous eruptions, rheumatism, gout, bronchitis, whooping-cough, nasal, vesical, and pulmonary catarrhs, mania with strong venereal desire, neuralgia. *Poisoning:* Same as for belladonna. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Dulcamaræ* (diluted alcohol), dose, ʒss–1 (2–4 cc.).

2. *S. carolinen'se, Solanum, Horse-nettle, Berries, N.F.*—The air-dried ripe fruit with not more than 5 p. c. of immature fruit nor 2 p. c. of foreign organic matter; C. and S. United States. Perennial herb, .3–.6 M. (1–2°) high, stellate-pubescent, grayish-green, sharp yellow prickles. Fruit, globose, shriveled, .8–2 Cm. ($\frac{1}{3}$–$\frac{4}{5}'$) thick, orange-yellow, glabrous, fleshy, 2-celled, many-seeded, calyx persistent; stellate, pubescent, enclosing half of berry, seed orbicular, flat, yellow, shining; odor pepper-like; taste bitter, acrid. Powder, brownish—numerous fragments of seed-coat and epicarp, cells with yellowish amorphous content; solvent: diluted alcohol; contains solanine, solanidine, resin, fat, volatile oil, ash 6 p. c. Tonic, antiepileptic, antitetanic; tetanus, epilepsy, convulsions—albuminuria, pregnancy; better than bromides; disastrously fatal to cattle. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Solani* (67 p. c. alcohol), dose, ʒss–1 (2–4 cc.); *Tincture. S. panicula'tum*, S. America; tonic, diuretic, antiperiodic; vesical catarrh.

3. *Sco'pola carniol'ica, Scopola.* The dried rhizome containing .5 p. c. of mydriatic alkaloids, U.S.P. 1900; C. Europe, Germany, Austro-Hungary, Carniola. Shrub, 20–60 Cm. (8–24′) high, usually branchless; leaves oblong-lanceolate, wavy or notched toward apex, petiolate, reticulate, flowers tubular, campanulate, brownish-purple; fruit capsule, circumscissile, dehiscent. Rhizome flexuous, cylindraceous, mostly in pieces 2.5–7.5 Cm. (1–3′) long, .8–1.6 Cm. ($\frac{1}{3}$–$\frac{2}{3}'$) thick, often split before drying; upper surface with large, closely set cup-shaped stem-scars, margins irregularly contracted, brownish, longitudinally wrinkled, obscurely annulate, nodular-roughened, fracture short, sharp; wood indistinctly radiate, central pith horny; nearly inodorous; taste sweetish, bitterish, acrid; solvents: 80 p. c. alcohol, water partially; contains scopolamine .05 p. c., hyoscyamine .5 p. c., atropine, scopoletin, ash 7-10 p. c. Mydriatic, analgesic,

hypnotic, antiphlogistic; glaucoma, ptyalism, hyperidrosis. Should not be given in renal affection nor in advanced age, and cases of poisoning should be treated as in belladonna. Dose, gr. 1–3 (.06–.2 Gm.); extract, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.); scopolamine, gr. $\frac{1}{250}$–$\frac{1}{60}$ (.00025–.001 Gm.). *S. japon'ica, Japanese Belladonna*, plant resembles very closely *S. carniolica*, differing only in having the style curved, calyx-teeth unequal, leaves less obovate with longer petioles; rhizome 10 Cm. (4′) long, 12 Mm. ($\frac{1}{2}$′) thick; this also yields atropine, scopolamine, etc.

a

FIG. 358.—*Scopola carniolica: a*, flowering and fruiting branch ($\frac{1}{4}$ nat. size); also flower, stamen, anther, pistil, fruit, seed, enlarged.

4. *Mandrag'ora officina'lis* (*Atropa mandragora*), together with var. *autumna'lis*, having blue flowers, and var. *verna'lis*, white flowers; S. Europe—all are acaulescent plants, having constituents similar to those of belladonna.

5. *Lyc'ium vulga're.*—United States, Europe; *L. af'rum*, N. Africa, and *L. umbro'sum*, S. America; leaves of all in infusion good for erysipelas and skin diseases.

HYOSCYAMUS. HYOSCYAMUS, *U.S.P.*

Hyoscyamus niger, *Linné.*

The dried leaf, with or without the tops, with not more than 2 p. c. stems, none more than 7 Mm. ($\frac{1}{4}$′) thick, yielding not less than .065 p. c. alkaloids, nor more than 12 p. c. acid-insoluble ash.

Habitat. Europe, Asia, waste places, neglected ruins, old gardens, sandy soil; naturalized in N. America (New England to Michigan); cultivated in England, etc.
Syn. Hyosc., Henbane, Black Henbane, Hog's-bean, Poison Tobacco, Fetid (Stinking) Nightshade, Insane-root, Henbell; Br. Hyoscyami Folia; Fr. Jusquiame noire, Feuilles Jusquiame noire, Belene, Chenile; Ger. Folium(-a) Hyoscyami, Bilsenkrautblätter.
Hy-os-cy'a-mus. L. fr. Gr. ὑός, a hog, + κύαμος, a bean, hog bean—*i. e.*, its fruit (bean) acts on swine and fowls, as a poison or intoxicant, but cows, horses, dogs, and goats can tolerate a great quantity.
Ni'ger. L. black—*i. e.*, inside throat of flowers purplish-black.
Hen'bane. Hen + *bane*—*i. e.*, whole plant fatal to poultry—bane to hens.

PLANT.—Biennial herb, .6–1.3 M. (2–4°) high; stem subcylindrical, somewhat compressed, longitudinally wrinkled, green, appearing 2d year, covered with long, soft, jointed, glandular, white hairs, viscid, clammy, fetid odor; root large, brown, interior white, wrinkled, compact, fibrous; flowers May–June, 3 Cm. ($1\frac{1}{5}'$) long, anthers and style

FIG. 359.—*Hyoscyamus niger:* flowering branch.

FIG. 360. — Hyoscyamus calyx, containing capsule, natural size.

purple. LEAVES (LEAF), usually much wrinkled, matted, broken (with leaves, stems, flowering and fruiting tops), 25 Cm. (10′) long, 10 Cm. (4′) broad, ovate-lanceolate, inequilateral, lower with short petiole, upper sessile, acute, coarsely and angularly 1–4-toothed (lobed), hairy grayish-green; stems 2–7 Mm. ($\frac{1}{12}$–$\frac{1}{4}'$) thick, cylindrical, wrinkled, hairy; flowers nearly sessile, with urn-shaped, hairy, unequally 5-toothed calyx, campanulate corolla, yellowish with purplish veins; fruit 2-locular pyxis (capsule) 12 Mm. ($\frac{1}{2}'$) broad, enclosed in calyx; odor distinctive; taste bitter, acrid. POWDER, grayish-green—glandular and non-glandular hairs, calcium oxalate crystals, prisms, rosette aggregates, sclerenchyma fibers, pollen grains, epidermal cells of seed-

coat with thick walls incrusted with granular crystals of silicic acid; *H. mu'ticus* (leaves, powder) recognized by characteristic, branching, non-glandular hairs. *Solvents:* diluted alcohol; boiling water partially. Dose, gr. 2–10 (.13–.6 Gm.).

ADULTERATIONS.—Leaves of allied species, also of stramonium, digitalis, belladonna, verbascum.

Commercial.—Plant by cultivation has become so diversified as to give varieties and almost species, all differing somewhat in medicinal strength; the annual form is usually .3–.6 M. (1–2°) high, having smaller parts, less toothed leaves, and faintly or not purple-veined corolla; the biennial form produces in the first year a fleshy fusiform root (resembling that of parsley for which it has been eaten with serious results), and a radical rosette of large, coarsely toothed (lobed), long petioled leaves, and in the second year the flowering and fruiting stem, after which it dies; in this latter stage the root is spongy, hollow, while the radical leaves are wanting, those of the stem being broader, shorter petioled, and sessile at apex. The stem leaves of the biennial plant are, as a rule, stronger and should be collected when two-thirds of the flowers have expanded; leaves of the first year, as also those of the annual plant, are often of equal strength; the perfect biennial root is three times richer than any other portion.

CONSTITUENTS.—Mydriatic alkaloids .05–.3 p. c.: Hyoscyamine, Scopolamine (Hyoscine), Hyoscipicrin, choline, mucilage, albumin, chlorophyll, potassium nitrate 2 p. c., ash 30 p. c. In the seed also fixed oil 25 p. c.

Hyoscyamine, $C_{17}H_{23}O_3N$.—A crystalline alkaloid obtained from the mother-liquors of atropine, or by freeing hyoscyamus seed of fat by petroleum benzin, drying, exhausting with 85 p. c. alcohol, adding hydrochloric acid, reclaiming alcohol, treating filtered residue again with petroleum benzin (fat, coloring matter), rendering alkaline with ammonia or potassium carbonate, shaking with repeated portions of chloroform, evaporating chloroformic solution, purifying by solution in dilute sulphuric acid, filtering, crystallizing; to obtain alkaloid render aqueous solution alkaline, extract with chloroform, evaporate; yield—leaves: .041–.224 p. c.; seed: .08–.16 p. c.; root: .006–.307 p. c. Occurs in white silky needles; if impure, deliquescent, becoming brown; identical with duboisine, isomeric with atropine, into which it is converted by heating to 120° C. (248° F.) for 6 hours; it also splits into tropine, $C_8H_{15}ON$, and tropic acid, $C_9H_{10}O_3$, and forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

Hyoscyaminæ Hydrobromidum, Hyoscyamine Hydrobromide, $C_{17}H_{23}O_3N.HBr$, *U.S.P.*—(Syn., Hyoscyamin. Hydrobr., Hyoscyamine Bromide, Hyoscyaminæ Hydrobromas; Fr. Bromure d'Hyoscyamine; Ger. Hyoscyaminum hydrobromicum, Hyoscyaminbromid.) This hydrobromide of the preceding alkaloid is obtained by dissolving hyoscyamine (10) in 25 p. c. hydrobromic acid (11), concentrating, crystallizing; it is in white, odorless, deliquescent crystals, very soluble

in water, alcohol (2.5), chloroform (1.7), ether (2260); aqueous solution (1 in 20) neutral, levorotatory, melts at 152° C. (306° F.). *Tests:* 1. Aqueous solution + silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid. 2. Shake 1 cc. of aqueous solution (1 in 10) with chloroform 2 cc., + few drops of chlorine T. S.—chloroform brownish. 3. Add .01 Gm. to 5 drops of nitric acid, evaporate to dryness; residue + alcoholic potassium hydroxide T. S.—violet color. 4. Aqueous solution (1 in 20) with platinic chloride T. S.—no precipitate (dif. fr. most other alkaloids); incinerate .1 Gm.—ash negligible. *Impurities:* Atropine, scopolamine, other alkaloids, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

FIG. 361.—Hyoscyamus: view of upper side of leaf revealing through epidermis the stomata and crystals (*K*) and palisade cells (*p*), and fibro-vascular bundles (*fv*).

Scopolamine (Hyoscine, Amorphous Hyoscyamine), $C_{17}H_{21}O_4N$. This exists in various plants of the Solanaceæ, being chemically and otherwise identical with hyoscine, and thought to consist of two bases, scopolamine and atrosin (optically inactive scopolamine); it is obtained from the mother-liquor of hyoscyamine by adding gold chloride, to form a less soluble gold double salt, which crystallizes out, dissolving this in water, removing gold by hydrogen sulphide, precipitating scopolamine with potassium carbonate. It is a semi-liquid tenacious mass, isomeric with hyoscyamine, levorotatory, yielding tropic acid and pseudotropine, $C_8H_{15}ON$; forms numerous salts (hydrobromide, hydrochloride, sulphate, etc.).

Scopolaminæ Hydrobromidum, Scopolamine Hydrobromide, $C_{17}H_{21}O_4N.HBr.3H_2O$, *U.S.P.*—(Syn., Scopolamin, Hydrobrom., Scopola-

mine Bromide (Hydrobromate); Br. Hyoscine Hydrobromide; Fr. Bromhydrate d'Hyoscine; Ger. Skopolaminhydrobromid.) Obtained by dissolving scopolamine in slight excess of diluted hydrobromic acid, concentrating, crystallizing. It is in colorless, transparent, rhombic crystals, some large; odorless, slightly efflorescent, levorotatory, very poisonous (use great care in tasting and then only in dilute solution); soluble in water (1.5), alcohol (20), slightly in chloroform, insoluble in ether, aqueous solution (1 in 20) neutral, slightly acid; melts when anhydrous at 191° C. (376° F.). *Tests:* 1. Dry to constant weight—loses 13 p. c.; over sulphuric acid—loses water of crystallization slowly; incinerate .1 Gm.—ash negligible. 2. Add .01 Gm. to 5 drops of nitric acid, evaporate to dryness, add alcoholic potassium hydroxide T. S.—violet color; aqueous solution with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid. 3. Shake aqueous solution (1 in 20) 1 cc., to which a few drops of chlorine T. S. have been added, with chloroform 1 cc.—chloroform brownish color. 4. To 1 cc. aqueous solution (1 in 20) add few drops of ammonia T. S.—no turbidity; add to another 1 cc. potassium hydroxide T. S.—whitish transient turbidity (abs. of foreign alkaloids). *Impurities:* Apoatropine, morphine, foreign alkaloids, carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{250}$–$\frac{1}{100}$ (.00025–.0006 Gm.); hypodermically, gr. $\frac{1}{400}$–$\frac{1}{200}$ (.00015–.0003 Gm.).

Hyoscipicrin, $C_{27}H_{52}O_{14}$.—A neutral, bitter glucoside, soluble in water, alcohol, precipitated by tannin, converted by hydrochloric acid into fermentable sugar, and a yellowish, acrid, bitter resin.

PREPARATIONS.—1. *Extractum Hyoscyami.* Extract of Hyoscyamus. (Syn., Ext. Hyosc., Extract of Henbane; Fr. Extrait de Jusquiame; Ger. Bilsenkrautextrakt.)

Manufacture: PILULAR, macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain .25 p. c. of total alkaloids; mix thoroughly. POWDERED, macerate, percolate 100 Gm. with alcohol, reserve first 100 cc., continue until exhausted; reclaim alcohol from 2d percolate until residue in still is 10 cc., to which add 1st reserve and distil until residue of syrupy consistence; transfer to a dish, rinse still with a little warm alcohol, which add to dish, evaporate at 70° C. (158° F.) to soft extract, stirring frequently, add dried starch 5 Gm., heat, with stirring, until nearly dry, now incorporate thoroughly dried starch 2 Gm., expose to current of warm air until dry, pulverize; assay, add enough dried starch for extract to contain .22–.28—.25 p. c. of the alkaloids; mix thoroughly; 1 Gm. represents about 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Preps.: 1. *Mistura Chloralis et Potassii Bromidi Composita, N.F.*, $\frac{1}{5}$ p. c. 2. *Pilulæ Catharticæ Vegetabiles, N.F.*, $\frac{1}{2}$ gr.

2. *Fluidextractum Hyoscyami.* Fluidextract of Hyoscyamus. (Syn., Fldext. Hyosc., Fluid Extract of Hyoscyamus, Fluidextract of Henbane; Fr. Extrait fluide de Jusquiame; Ger. Bilsenkrautfluidextrakt.)

Manufacture: Similar to Fluidextractum Colchici, page 111; menstruum: 75 p. c. alcohol; after dissolving soft extract in the reserve, assay, and add enough menstruum for the 100 cc. to contain .055–.075—.065 Gm. of total alkaloids. Dose, ♏ij–10 (.13–.6 cc.).

3. *Tinctura Hyoscyami.* Tincture of Hyoscyamus. (Syn., Tr. Hyosc., Tincture of Henbane; Fr. Teinture de Jusquiame; Ger. Bilsenkrauttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol—percolate 95 cc., assay, and add enough menstruum for the 100 cc. to contain .0055–.0075—.0065 Gm. of total alkaloids. Dose, ʒss–1 (2–4 cc.).

4. *Oleum Hyoscyami Infusum, N.F.*, leaves 10, alcohol 10, ammonia water .2, sesame oil q. s. 100: Prep.: 1. *Oleum Hyoscyami Compositum,* Balsamum Tranquillans, *N.F.*, oils of lavender, peppermint, rosemary, thyme, āā .2, infused oil of hyoscyamus q. s. 100.

Unoff. Preps.: Abstract (alcohol), gr. 1–5 (.06–.3 Gm.). *Extractum Hyoscyami Viride*—express juice, heat, strain, evaporate, add coloring matter strained out, gr. 2–8 (.13–.5 Gm.). *Infusion,* 5 p. c., ʒj–3 (4–12 cc.). *Succus Hyoscyami*—expressed juice (3), and alcohol (1), ʒss–1 (2–4 cc.). *Baume Tranquille* (Fr. Codex)—leaves of hyoscyamus, belladonna, stramonium, black nightshade, poppy, āā 50 Gm., macerate in alcohol 200 cc., add poppy seed oil 5000, heat for 6 hours, strain, cool, add oils of lavender, peppermint, rosemary, thyme, āā 1; used externally.

Properties.—Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative, similar to belladonna, stramonium, and duboisia, but less powerful and irritating, yet the most calmative and hypnotic of the group, sedative to urinary tract. Hyoscyamine is less active than atropine; it is more an anodyne or anesthetic than narcotic or soporific, depresses spinal but excites cerebral function. Scopolamine (hyoscine) is much stronger than hyoscyamine, being a powerful cerebral and spinal sedative; lessens pulse and respiration; habitually used produces muscular paralysis, violent delirium.

Uses.—Mostly with children, and where opium is contraindicated; acute and chronic mania, delusional insanity, insomnia with hallucinations, delirium tremens, monomania of hypochondriacs, whooping-cough, nervous cough, colics, tremor in paralysis, mercurial poisoning, locomotor ataxia, irritation of bladder, constipation, chorea, tetanus, morphine habit, corrective to griping and nauseating medicine.

Poisoning: Same as for belladonna; but for scopolamine (hyoscine) use chiefly chloral hydrate.

Incompatibles, Synergists: Same as those of belladonna.

Hyoscyami Semen.—U.S.P. 1830–1870. These are stronger than leaves, and used mostly for extraction of alkaloids; they are roundish

reniform, flattened, 1–1.5 Mm. ($\frac{1}{25}$–$\frac{1}{16}'$) long, testa finely pitted, grayish-brown, sharp near the raised portion (dif. from stramonium seed), inodorous, taste oily, bitter, acrid. Dose, gr. 1–5 (.06–.3 Gm.).

Allied Plants:

1. *Hyoscyamus pal'lidus.*—Flowers are pale yellow and have no purple (*niger*) veins in the corolla. *H. agres'tis* (of the field, wild); small annual, .3 M. (1°) high, less villous; with leaves smaller, and fewer flowers. *H. mu'ticus*, leaves yellowish, stem remnants and calyxes longer, trichomes prominent and branched. *H. al'bus* and *H. au'reus*, the former with white flowers, the latter with golden-yellow; both less active than the official.

2. *Duboi'sia myoporoi'des.*—Australia. Small tree having properties similar to those of belladonna and hyoscyamus; leaves 7.5–10 Cm. (3–4′) long, 12–25 Mm. ($\frac{1}{2}$–1′) broad, petiolate, midrib prominent, entire, taste bitter; contains duboisine .3–1 p. c., a volatile alkaloid (mixture of hyoscyamine, scopolamine, and atropine), which forms numerous salts. Dose of leaves, gr. 1–3 (.06–.2 Gm.), duboisine hydrobromide or sulphate, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.); used externally for eye affections, in solution (1 p. c. in water).

STRAMONIUM. STRAMONIUM, *U.S.P.*

Datura Stramonium, *Linné.* — The dried leaves and flowering tops, with not more than 3 p. c. stems over 8 Mm. ($\frac{1}{3}'$) thick, nor 4 p. c. acid-insoluble ash, yielding not less than .25 p. c. alkaloids.

Habitat. Asia; naturalized universally (Europe, England, N. America, etc.).

Syn. Stramon., Jamestown Weed, Jimson Weed, Thorn-apple, Devil's (Mad) Apple, Stink-weed, Stink-wort, Devil's Trumpet, Fire-weed, Jamestown Lily, Apple of Peru; Br. Stramonii Folia; Fr. Stramoine, Pomme Épineuse, Feuilles de Stramoine; Ger. Stechapfel, Dornapfel, Stechapfelblätter.

Da-tu'ra. L. fr. Hind. *dhatura*, a plant, or an alteration of Ar. *tatorah*—*i. e.*, their name for the plant.

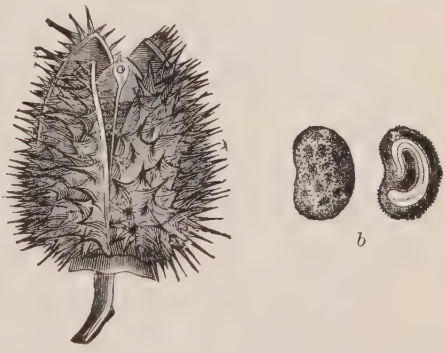
Stra-mo'ni-um. L. contr. of Gr. στρύκνον μανικόν, used by Dioscorides for this and for *Atropa Belladonna*.

Jimson-weed. For Jamestown, Va., where first found growing on ship rubbish.

Plant.—Course annual bushy herb, rank, noxious odor; stems cylindrical, flattened, longitudinally wrinkled, occasionally 1–more-furrowed, succulent, greenish, purplish-brown, nearly solid, 1–1.5 M. (3–5°) high, 2.5–4 Cm. (1–1$\frac{3}{5}'$) thick, 2 3-branched above ground; root tapering, white; flowers June–Sept., calyx tubular, green, 4 Cm. (1$\frac{3}{5}'$) long, 5's, corolla white, purplish, tubular, funnel-shaped, 7.5–10 Cm. (3–4′) long, 5 Cm. (2′) broad, 5's; fruit capsule, 5 Cm. (2′) long, ovate, obtusely quadrangular, covered with unequal, sharp, rigid spines, 4-celled, dehiscing half-way down into 4 segments; ovary 2-carpelled, 2-celled; seed numerous, brownish-black, angled, flattened, 4 Mm. ($\frac{1}{6}'$) long. Leaves, 5–30 Cm. (2–12′) long, 4–15 Cm. (1$\frac{3}{5}$–6′) broad, usually matted, wrinkled, crushed, petiolate, inequilaterally

ovate, acuminate, sinuate-toothed or angled, teeth few, acute with rounded sinuses, sparsely hairy, dark green, under surface light green; stems often flattened, wrinkled, furrowed; odor distinct, heavy, narcotic taste unpleasant, nauseous. POWDER, brownish-green—stomata with 3 neighboring cells, calcium oxalate in rosette aggregate crystals; non-glandular hairs, few glandular hairs, tracheæ, stem fragments with spiral tracheæ, wood-

FIG. 362.—*Datura Stramonium:* flowering branch.



a *b*

FIG. 363.—*Datura Stramonium: a,* fruit; *b,* stramonium seed and section, magnified 3 diam.

fibers, collenchymatous cells, parenchyma cells, microcrystals, no bast-fibers. *Solvents:* 75 p. c. alcohol; diluted alcohol; hot water partially. Dose, gr. 1–5 (.06–.3 Gm.).

ADULTERATIONS.—Leaves of allied species (usually smaller), belladonna, French cultivated, and *Xan'thium Struma'rium.*

Commercial.—Plants were known possibly to the ancients, but not described until the 16th century (Gerarde), nor introduced into medicine before 1672 (Störck). They infest fields, roadsides, waste places, near houses (never in mountains or woods), exhale rank, heavy, repellant narcotic odor, and grow well with us, especially in Michigan and other western States, all parts being medicinal. Gypsies brought leaves and seeds to Europe from Asia in the middle ages, and used the smoke therefrom to intoxicate their dupes. Leaves should be gathered while flowering, by pulling up entire plant, then quickly removing and drying, by which they often become broken or cut into pieces.

CONSTITUENTS.—Daturine .2–.4 p. c., volatile oil (containing daturic acid, $C_{17}H_{34}O_2$), chlorophyll, mucilage, albumin, potassium nitrate, ash 17–20 p. c.

Daturine.—An alkaloid combined with malic (daturic) acid, and consisting of hyoscyamine, atropine (the former usually predomi-

nating), and probably little scopolamine (hyoscine); forms salts (hydrochloride, sulphate, etc.). Dose, gr. $\frac{1}{120}$–$\frac{1}{60}$ (.0005–.001 Gm.).

PREPARATIONS.—1. *Extractum Stramonii.* Extract of Stramonium. (Syn., Ext. Stramon.; Fr. Extrait de Feuilles de Stramoine; Ger. Stechapfelblätterextrakt.)

Manufacture: PILULAR, macerate, percolate 100 Gm. with 75 p. c. alcohol until exhausted, reclaim alcohol, evaporate residue at 70° C. (158° F.) to pilular consistence, frequently stirring, mix thoroughly; after assay add enough glucose for extract to contain 1 p. c. of total alkaloids, mix thoroughly. POWDERED, macerate, percolate 100 Gm. with alcohol, reserve first 100 cc. and continue until exhausted (100 cc.); reclaim alcohol from second percolate until residue in still is 10 cc., to which add first reserve and distill until residue of syrupy consistence; transfer to a dish, rinse still with little warm alcohol, which add to dish and evaporate at 70° C. (150° F.) to soft extract, frequently stirring, add dried starch 5 Gm., heat, with stirring, until nearly dry, thoroughly incorporate dried starch 2 Gm., expose to current of warm air until dry, pulverize; after assay add enough dried starch for extract to contain 1 p. c. of total alkaloids, mix thoroughly, pass through fine sieve; contains .9–1.1—1 p. c. of the alkaloids; 1 Gm. represents 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

Prep.: 1. *Unguentum Stramonii, N.F.*, pilular ext. 10 p. c., hydrous wool fat 20, benzoinated lard 65, diluted alcohol 5.

2. *Tinctura Stramonii.* Tincture of Stramonium. (Syn., Tr. Stramon.; Br. Tinctura Stramonii, Tincture of Stramonium; Fr. Teinture de Stramoine; Ger. Stechapfeltinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol—percolate 95 cc., assay, and add enough menstruum for the 100 cc. to contain .0225–.0275—.025 Gm. of total alkaloids. Dose, ♏v–30 (.3–2 cc.).

3. *Fluidextractum Stramonii, N.F.*, (80 p. c. alcohol). Dose ♏j–5 (.06–.3 cc.).

Unoff. Preps.: Plaster, Juice (*Succus Stramonii*), Cigarettes, Fomentation.

PROPERTIES.—Narcotic, anodyne, antispasmodic, diuretic, mydriatic. Internally very similar but stronger than belladonna; weaker externally. Large doses produce dry throat, cardiac irregularity, high fever with delirium, increase sexual desire, possibly laughing and hallucinations (like in cholera, alcoholism), dizziness, fainting, red eruptions, dilated pupils, insomnia, black objects appear green; pneumogastric becomes paralyzed, thus stopping the inhibitory action, hence whole system paralyzed finally by over-stimulation, including the heart, then delirium, stupor, convulsions, death by asphyxia; in case of recovery remember nothing that has occurred; does not affect some animals, as caterpillar tribe, goats, etc.

Uses.—Insanity, mania, melancholia, epilepsy, nervous asthma (gr. 15 (1 Gm.) of leaves smoked with tobacco or sage at each paroxysm), whooping-cough, dysmenorrhea, retention of urine, hepatic colic, laryngeal cough, chorea. Ointment in ulcers, hemorrhoids, fissures, skin diseases, poison-ivy eruptions, rheumatism, bruises, sprains. In the absence of belladonna may use stramonium with good results.

Poisoning, Incompatibles, Synergists: Same as for belladonna.

Allied Plants:

1. *Datura Tat'ula, Purple Thorn-apple.*—Similar to official and considered by some the same, but has purple stems, petiole, and corolla; was recognized, along with *D. Stramonium*, U.S.P. 1910.

2. *D. fastuo'sa (al'ba)—Daturæ Folia, Daturæ Semina* (Br.); India. Used natively as a criminal poison; capsule small, subglobular, spinous, seed yellowish-brown, triangular, rough. *D. Met'el, Entire-leaved Thorn-apple,* Africa, S. Asia; capsule and seed like *D. fastuosa (alba),* leaves nearly entire, downy. *D. sanguin'ea,* Peru; large shrub, or tree, leaves nearly entire, downy beneath, flowers large, upper half of corolla yellow, lower half blood-red.

3. *Brunfel'sia Hopea'na, Manaca, Mercurio Vegetal, N.F.*—The dried root; S. America, Amazon valley. A large shrub. Root nearly cylindrical, tortuous, variable length, 3 Cm. ($1\frac{1}{5}'$) thick, dark brown, wrinkled, yellowish cork patches easily removed from thin cortex adhering closely to hard yellowish wood; fracture short, very tough; odor slight; taste bitter. Powder, pale yellow—lignified fibers, medullary ray cells, tracheæ, few cork cells, cortical parenchyma with brownish amorphous content, starch grains, stone cells, calcium oxalate rosettes; solvent: diluted alcohol; contains resin, alkaloid (? manacine). Motor depressant (spinal centers); full doses—difficult breathing, profuse sweating, depression, nausea, vomiting, urination, purgation; over-doses—acrid depressing poison; chronic muscular rheumatism, syphilis (substitute for mercury). Dose, gr. 15–30 (1–2 Gm.); 1. *Fluidextractum Manacæ* (75 p. c. alcohol), dose, ♏xv–30 (1–2 cc.): Prep.: 1. *Elixir Manacæ Compositum,* 16.5 p. c., + sodium salicylate 14, lithium salicylate 1.75, salicylic acid 5.5, potassium bicarbonate 3.97 +, dose, ʒj–2 (4–8 cc.).

4. *Nicotia'na Tabac'um, Tabacum, Tobacco.*—The commercial dried leaves, U.S.P. 1820–1890; C. and S. America (cultivated). Coarse robust annual, 1–2 M. (3–6°) high; stem erect, unbranched, solid, green, hairy; root long, fibrous; flowers rose-color, calyx bell-shaped, hairy, viscid, corolla 4–5 Cm. ($1\frac{3}{5}$–$2'$) long, tubular, inflated; fruit ovate capsule, 2.5 Cm. ($1'$) long, opening at summit; seed many, reniform, reticulate, brownish. Leaves, about .5 M. ($20'$) long, 10–15 Cm. (4–$6'$) wide, ovate-lanceolate, acute, entire, waved, brown, friable, hairy; odor heavy, peculiar; taste nauseous, bitter, acrid. Plant not known to be wild, and leaves in curing undergo a sweating process (chemical change) by which odor is modified through generation of a new volatile principle, and amount of nicotine decreases owing to its

volatility; contains nicotine .7–5–11 p. c. (colorless oily liquid), nicoteine (nicotia) 2 p. c., nicotelline, nicotimine, pirolidine (?), nicotianin (tobacco camphor), tannin, resin, gum, malates, citrates, ash 14–18–27 p. c. (Ca, K, NH_4—phosphates, sulphates, malates, chlorides, nitrates); solvents: alcohol, hot water. Narcotic, sedative, diuretic, emetic, myotic, diaphoretic, cathartic, antiseptic; first stimulates (causing convulsions) then paralyzes motor nervous system (spine), produces vomiting, purging, collapse, contracted pupils, depressed then increased heart action (rapid, feeble pulse), cold extremities, death by paralysis of respiration and heart; excessive use causes dyspepsia, diminished sexual power, nervousness, angina pectoris, and in the young impairs body nutrition. So severe as to be little employed as a medicine, but may be used to relax spasms, relieve local pain, constipation, spasmodic asthma, tetanus, as an enema in intussusception, strangulated hernia, impacted cecum, hemorrhoids, scabies, strychnine poisoning. *Poisoning:* By tobacco or nicotine, give tannin, emetics, then strychnine (physiological antidote), alcohol, ammonia, digitalis, belladonna, iodides, artificial respiration, maintain recumbent position; tobacco heart (cardiac irregularity and palpitation)—abandon use. The toxic effect of tobacco smoke is mostly due to nicotine, but there are present collidine, pyridine, picoline, ethylamine, acids, etc. Dose, gr. ½–3 (.03–.2 Gm.); wine (vinum), 10 p. c., ♏v–60 (.3–4 cc.); enema tabaci, 5 p. c.; Oleum Tabaci, U.S.P. 1850–1870 (from distilling leaves—acrid, poisonous, dark brown oily liquid); aqueous extract, fluidextract, infusion, ointment, poultice.

Fig. 364.—*Nicotiana Tabacum.*

N. rus'tica, Wild Tobacco, and *N. quadrival'vis,* Canada, E. United States. *N. repan'da,* Cuba. *N. Per'sica,* Persia. *N. rustica,* cultivated in Turkey, India, etc. All may be used similarly.

5. *Fabia'na imbrica'ta, Pichi.*—Peru, Chile. Plant 1.5–2 M. (5–6°) high, growing on rocky hill-tops, resembling somewhat the pines; the woody branches are used, being resinous, with aromatic odor and taste; contain fabianine, resin, volatile oil. Diuretic, tonic, cholagogue; chronic vesical catarrh, gravel, renal, urethral, or cystic calculi. Should not be used in organic disease. Dose, gr. 5–40 (.3–2.6 Gm.).

62. SCROPHULARIACEÆ. Figwort Family.

Skrof-u-la-ri-a'se-e. L. *Scrophulari-a* + aceæ—*i. e.*, from its efficacy in scrofula. Herbs, rarely shrubs. Distinguished by stamens 2–4–5,

didynamous or 2 perfect, inserted on 2-lipped corolla-tube; flowers irregular, 4–5's, 2-lipped; ovary 2-celled, central placenta, superior, style 1; seeds many in fleshy albumin; fruit, capsule or berry; universal; bitter, astringent, emetic, purgative, diuretic, narcotic, poisonous, often cultivated for beautiful flowers.

Genus: **1. Digitalis.**

DIGITALIS. DIGITALIS, *U.S.P.*

Digitalis purpurea, *Linné.* — The dried leaf, assayed biologically (frog), with not more than 2 p. c. browned leaves, stems, flowers or foreign organic matter, yielding not more than 5 p. c. acid-insoluble ash.

Habitat. W. and C. Europe; in sandy soil, edges of woods, thickets; naturalized in Australia, Oregon, etc.

Syn. Digit., Foxglove, American or Purple Foxglove, Fairy Gloves, Folks' or Ladies' Glove, Dog's Finger, Fairy Fingers, Dead Men's Bells, Finger Flower, Thimbles, Fairy Cap, Lion's Mouth, Scotch Mercury, Throatwort, Rabbit's flower; Br. Digitalis Folia; Fr. Feuilles de Digitale pourprèe (de grande Digitale), Doigtier; Ger. Fingerhutblätter.

Dig-i-ta'lis. L. pertaining to the fingers, fr. *digitus*, a finger—*i. e.*, the finger-shaped corolla, named by Fuchs, 1542, after Ger. *fingerhut*, a thimble.

Pur-pu're-a. L. *purpureus*, purple-colored—*i. e.*, its purple flowers.

Foxglove. Corruption of *Folks' glove, Folk*, synonym of *Fairies.*

Plant.—Biennial or perennial, succulent, downy, leafy herb, .6–1.5 M. (2–5°) high; flowers July–Aug., tubular, campanulate, 5-lobed, outside purple, inside dark-spotted upon a white ground, mouth hairy, terminal, 1-sided racemes; one variety with white flowers; fruit 2-celled pyramidal capsule; seed many, small, brownish-gray. Leaves (Leaf), more or less crumpled or broken, 10–25 Cm. (4–10′) long, 5–15 Cm. (2–6′) broad, contracted into winged petiole, crenate, irregular, thin, dark green above, grayish beneath from dense tomentose pubescence, venation reticulate, midrib and principal veins broad and flat, larger veins often purplish, lower veins continued into the wings of petiole; odor slight (dry), peculiar and characteristic (moist); taste very bitter. Powder, dark green—numerous fragments of epidermis, non-glandular hairs 2–8-celled, few glandular hairs, fragments of veins and petioles with tracheæ, no calcium oxalate. Should be kept, thoroughly dried, in air-tight containers. *Solvents:* 75–83 p. c. alcohol; boiling water partially. Dose, gr. 1 2 (.06–.13 Gm.).

Fig. 365.—*Digitalis purpurea.*

SCROPHULARIACEÆ

ADULTERATIONS.—LEAVES: First year's leaves—radical, with very long petioles; also leaves of *D. ambig'ua* (*ochroleu'ca*)—nearly smooth; *Verbascum Thapsus*—yellowish-white, entire, densely long-tomentose, mucilaginous; *Sym'phytum officinale*—entire, scabrous; *Cony'za* (*Inula*) *squarrosa*—scabrous, entire. POWDER: Distinguished from all adulterations by the 2–8-celled hairs and absence of calcium oxalate crystals.

FIG. 366.—*Digitalis purpurea: a*, single flower; *b*, the same opened.

Commercial.—Plant cultivated for ornament and medicine, producing the first year a large fleshy root and a rosette of radical leaves, but no flowering and fruiting stem until the second year. Leaves

FIG. 367.—Digitalis leaves, upper surface: *a*, of the first year's growth; *b*, of the second year's growth.

should be collected from wild plants growing in mountainous regions when two-thirds of the flowers are expanded, July-Sept., from the fact that two series of compounds are formed in plants by the action of light and air: 1, *nutritious*, those for nutrition (constructive metab-

olism); 2, *secretious*, or secretions of waste products (destructive metabolism). It is only during the flowering stage that every nutritive avenue and substance is taxed and used for flower perfection, thereby leaving elsewhere, as in leaves, etc., the waste products, alkaloids, etc., in a most concentrated form; for the same reason belladonna, hyoscyamus, and many other plants should have leaves (all official parts) gathered when in bloom—the second year of growth, hence the second crop of leaves. However, some claim that most digitoxin is present before flowering, and inversely proportional to moisture in herbage. Only those full grown and fresh are collected, then carefully and quickly dried without exposure to sun or undue heat, and protected from external moisture, each being placed separate, or in baskets, in dark drying stoves; or the entire plant may be hung up carefully by the roots in a current of warm air, such yielding most digitoxin, that by which the drug's value is determined; carelessness in this process often renders the product inert. When dry should be kept in air-tight, dark containers (or tins, over lime—old Dutch method), and not longer than 1 year if exposed to light and moisture, as quality depends upon color, odor, taste, and yield of digitoxin; seed are much stronger, keep better, and do not deteriorate upon drying; lose on drying 75 p. c.; cultivated leaves are thicker, deeper color, less hairy, active and acute.

CONSTITUENTS.—Digitoxin, Digitophyllin, Gitalin (digitalein, digalen), digitonin, gitin, digitsaponin (digitalin + saponin), enzymes, manganese, volatile oil, fixed oil 5 p. c., gum, starch, sugar, chlorophyll, inosit, pectin, coloring matter (red, yellow), digitalosmin, antirrhinic acid, digitalic (malic) acid, ash 15 p. c.

Digitoxin, Digitophyllin, Gitalin (digitalin-group).—Heart stimulant glucosides, the two former soluble in alcohol, the latter also in water, which alone occurs (+ digitsaponin) in the infusion, making it possibly the most important content.

Gitin, Digitsaponin (saponin-group).—Inactive, but presence may increase the activity of the glucosides.

Enzymes (oxydases—only in fresh leaves).—Oxidize or hydrolyze the glucosides (digitoxin, digitophyllin, gitalin) into glucose, digitoxigenin and digitaligenin—all inactive, the associated manganese aiding in the decomposition—this latter being averted only by quickly drying fresh leaves and keeping them dry.

Digitalin, Digitalinum.—This name has been given to four distinct substances each supposedly representing the important cardiac content; as such it may not exist in the drug, for, being very complex, it may become modified in process of extraction. Of these four varieties, two have commercial prominence: 1, *German*, mostly used with us, consisting of digitoxin, digitophyllin, digitalein (heart stimulants), chiefly digitonin (diuretic), digitalin and digitin (inert); yellowish-white amorphous powder, soluble in water, alcohol; 2, *French*—amorphous (yellowish-white, bitter powder), crystalline (needle-shaped

crystals, very bitter, insoluble in water—chiefly digitoxin). Digitalin may be obtained by precipitating alcoholic extracts with tannin, washing precipitate, or by heating German variety with alcohol (4) until dissolved, adding ether (5), setting aside, evaporating ether-alcoholic solution, adding water, setting aside to deposit, washing with alcohol. Owing to its varying composition uniform doses, become impossible; usual dose gr. $\frac{1}{60}$–$\frac{1}{30}$ (.001–.002 Gm.); crystalline, dose, gr. $\frac{1}{200}$–$\frac{1}{100}$ (.0003–.0006 Gm.).

Fig. 368.—Digitalis leaf: under surface.

Preparations.—1. *Infusum Digitalis.* Infusion of Digitalis. (Syn., Inf. Digit.; Fr. Tisane de Digitale; Ger. Fingerhutaufguss.)

Manufacture: 1.5 p. c. Macerate for 1 hour 1.5 Gm. with boiling water 70 cc., filter, add alcohol 10 cc., + cinnamon water 15 cc. to filtrate, pass through residue on the filter cold water q. s. 100 cc., mix well. Must be freshly prepared. Dose, ʒij–4 (8–15 cc.).

2. *Tinctura Digitalis.* Tincture of Digitalis. (Syn., Tr. Digit.; Fr. Teinture de Digitale; Ger. Fingerhuttinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: 80 p. c. alcohol. Exhaust 10 Gm., in glass percolator, with purified petroleum benzin until free from fat; air dry, and percolate with 80 p. c. alcohol; adjust the volume of finished tincture to conform to biological standard. Dose, ♏v–30 (.3–2 cc.).

3. *Fluidextractum Digitalis, N.F.* (83 p. c. alcohol), Dose, ♏j–2 (.06–.13 cc.).

4. *Pilulæ Digitalis, Scillæ et Hydrargyri, Niemeyer's (Guy's) Pills for Dropsy, N.F.*, 1 gr., + squill, mass of mercury, āā 1 gr.

Unoff. Preps.: Abstract: gr. $\frac{1}{4}$–1 (.016–.06 Gm.). *Extract* (evaporate fluidextract cautiously to one-fourth its volume), gr. $\frac{1}{6}$–$\frac{1}{2}$ (.01–.03 Gm.).

While the infusion is the best diuretic, the tincture is the best for heart action; this latter, and the fluidextract, owing to alcohol present, contains most digitoxin and digitophyllin, with little gitalin—some of the digitoxin being precipitated; the extract has also digitoxin, while infusion mostly gitalin, digitonin and digitsaponin.

Properties.—Cardiac tonic, vascular stimulant, diuretic, motor-excitant, paralyzant, anaphrodisiac, sedative, narcotic, emetic; normal doses make the pulse slower, firmer, stronger. The diastole (periodic

dilatation) is prolonged, owing to stimulation of the pneumogastric; the systole (periodic contraction) is not altered as to duration, but is in degree, the force being increased greatly, owing to stimulation of the heart muscle and its contained ganglia, which may be so powerful as to squeeze out all of the blood, thus causing death in systole by over-stimulation. Temperature is lowered by the lessening of blood supply to the tissues. Blood-pressure in the glomeruli of the kidneys is increased, causing diuresis. Recumbent position is best when under its influence. The rapid pulse is due to over-stimulation of the pneumogastric (inhibition) and consequent exhaustion, thus allowing the sympathetic alone to control the action. Digitalis and aconite slow the heart, otherwise are antagonistic; the former increases inhibition, stimulates motor apparatus; the latter does the converse, thus weakening

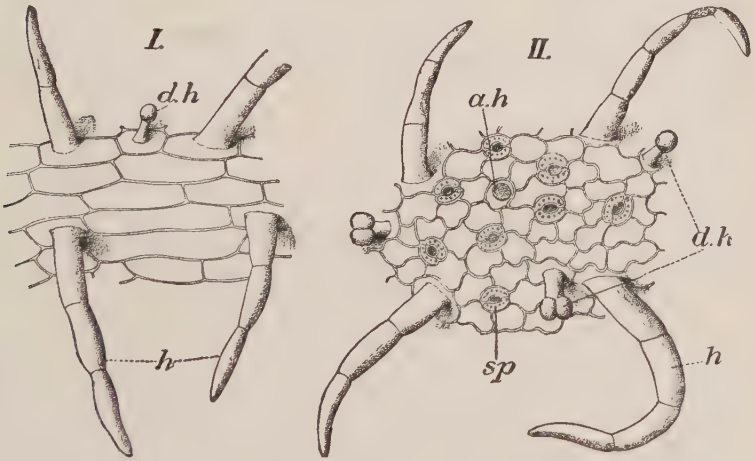


FIG. 369.—Digitalis leaf: *I*, epidermis of upper side seen from above with velvet hairs (*h*) and glandular hairs (*d.h*); *II*, epidermis of under side with stomata (*sp*), velvet hairs (*h*), glandular hairs (*d.h*), and the scar of a broken hair (*a.h.*) magnified 175 diam.

the beat, both finally paralyze cardiac ganglia—digitalis by over-stimulation, aconite by direct depression. Arterial tension is raised by digitalis, lowered by aconite; the latter acts quickly, the former slowly, possessing cumulative action—*i. e.*, several doses given at proper intervals may show no result until suddenly the combined action of all the doses is manifested at once, proving sometimes fatal if not very cautious. In consequence of this, aconite becomes a more valuable antagonist in digitalis poisoning than digitalis in aconite poisoning.

USES.—Where heart is rapid and feeble, deficient and poor circulation (as it causes the heart to expel much more blood than normally), renal disease, venous engorgement, dropsy, pneumonia, scarlet fever, congestive headache, hemicrania in mania, delirium tremens, hemorrhages, menorrhagia, rheumatic fever, spermatorrhea, pleurisy, peri-

carditis, chronic bronchitis, epilepsy. Locally to enlarged glands, abdominal and renal dropsy.

Poisoning: Have sneezing, nausea, vomiting of mucus, bile, and dark green matter, colic, purging with severe pain, headache; heart beats violently; pulse small and shallow, yet upon rising rapid, weak, and irregular; vertigo, yellow vision, face pale, pupils usually dilated, sometimes contracted, eyeballs protruding, sclerotic blue colored, pain in back and limbs, diarrhea, suppressed urine, salivation, conscious until near the end, delirium, coma, convulsions, death suddenly by paralysis of heart muscle. Wash out stomach with warm water and tannin, give diffusible stimulants (injections), aconitine (best to antagonize large quantities of digitalis), opium (best to antagonize long usage of digitalis), saponin, senegin (best physiological antagonist), Epsom or Rochelle salt, fluidextract of quillaja, and senega, external heat, horizontal position.

Incompatibles: Cinchona, tannin, iron sulphate, lead acetate, tincture of ferric chloride, syrupy and watery solutions, which may decompose drug's active principles.

Synergists: Cardiac stimulants, belladonna, ergot, etc.

Allied Plants:

1. *Veron'ica virgin'ica, Leptandra, Culver's Root, N.F.*—The dried rhizome and roots with not more than 5 p. c. of stem-bases or other foreign organic matter, yielding not more than 6 p. c. of acid-insoluble ash; N. America, low grounds. Perennial herb, .6–2 M. (2–6°) high, angular, smooth or downy; leaves lanceolate, serrate, 7.5–10 Cm. (3–4′) long, whorls; flowers, spikes, whitish, tubular, stamens 2, exserted; fruit small, compressed capsule. Rhizome, horizontal, nearly cylindrical, branched, 4–10 Cm. ($1\frac{3}{5}$–4′) long, 4–13 Mm. ($\frac{1}{6}$–$\frac{1}{2}$′) thick, grayish-brown, annulate from circular scars of bud-scales,

Fig. 370.—*Veronica officinalis:* flowering branch.

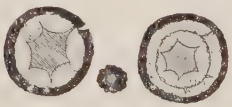


Fig. 371.—*Veronica virginica:* transverse sections of rhizome and root.

numerous stem-scars above, coarse roots on sides and beneath; fracture tough, woody, wood and bark thin, latter, resinous, pith large, more or less hollow; roots 1–10 Cm. ($\frac{2}{5}$–4′) long, .5–2 Mm. ($\frac{1}{50}$–$\frac{1}{12}$′) thick, with light brown central cylinder; odor characteristic; taste very bitter, acrid. Powder, yellowish-brown—numerous fragments with chloral

hydrate T. S.—pink or violet, starch grains, tracheæ, wood-fibers, parenchyma with brownish resin often adherent to starch grains in the cells preventing separation of latter; solvents: 75 p. c. alcohol, water; contains (mostly in bark) leptandrin, resin 6 p. c., tannin, saponin, gum, volatile oil. Emeto-cathartic, cholagogue, alterative, tonic; duodenal atony, chronic constipation with insufficiency of biliary and intestinal secretions; acts violently on some persons. Dose, gr. 15–60 (1–4 Gm.); 1. *Extractum Leptandræ* (75 p. c. alcohol), dose, gr. 1–5 (.06–.3 Gm.); 2. *Fluidextractum Leptandræ* (75 p. c. alcohol), dose, ♏xv–60 (1–4 cc.). Tincture, ʒj-2 (4–8 cc.); *leptandrin* (similar to podophyllin), gr. 1–5 (.06–.3 Gm.). *V. officinal'is, Common Speedwell;* Europe, N. America. —Procumbent, pubescent, perennial, stem ascending, 7.5–25 Cm. (3–10′) high; leaves obovate, petioled, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}$′) long, serrate, grayish-green; flowers axillary racemes, wheel-shaped, 4-parted, pale blue corolla with dark blue stripes, 2 exserted stamens; contains bitter principle, tannin; plant used as alterative, diuretic (urinary, calculus disorders), diaphoretic, expectorant (skin diseases, scurvy); in infusion. Dose, gr. 30–60 (2–4 Gm.).

Fig. 372.—*Verbascum Thapsus.*

2. *Verbas'cum Thap'sus, Verbasci Folia, Mullein Leaves, Great Mullein, N.F.*—The dried leaves with not more than 2 p. c. of foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; Europe, nat. in N. America—growing in fields, waste places. Stout woolly perennial, .3–1.3 M. (1–4°) high; flowers, spike, yellow, 2.5–4 Cm. (1–$1\frac{3}{5}$′) broad, thick, tough (moist), brittle (dry), greenish-gray, densely long-tomentose, numerous non-glandular hairs; nearly odorless; taste mucilaginous, slightly bitter. Powder, dark green—numerous lignified hairs, glandular hairs, epidermal cells, stomata, chlorenchyma with fibro-vascular tissue; solvent: diluted alcohol; contains resin, tannin, volatile oil, mucilage, sugar, ash 14 p. c. Demulcent,

pectoral, anodyne, nutritive; consumption, nasal catarrh, coughs—smoked. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Verbasci Foliorum* (diluted alcohol), dose, ♏xv–60 (1–4 cc.); Infusion.

3. *V. phlomoi'des*, or *V. thapsifor'me*, *Clasping-leaved Mullein*, *Verbasci Flores*, *Mullein Flowers*, *N.F.*—The dried corollas with adhering stamens and not more than 2 p. c. of foreign organic matter—flowers which have become brown should not be used. Plants similar to preceding; stem .3–1.2 M. (1–4°) high, usually simple; leaves oblong, crenate, woolly-tomentose; corolla light yellow, woolly, 14–30 Mm. ($\frac{3}{5}$–$1\frac{1}{5}$′) broad, rotate, 2-lipped, tube 1–2 Mm. ($\frac{1}{25}$—$\frac{1}{12}$′) long and broad; stamens 5, didynamous, filaments thick, fleshy, pollen grains smooth; odor peculiar, agreeable; taste mucilaginous; with boiling water—yellow, with dilute sulphuric acid—green, becoming brown with alkali; solvents: water, diluted alcohol; contains volatile oil, resin, tannin, fixed oil, gum, glucoside, coloring, ash 6 p. c. Diaphoretic, demulcent, diuretic, anodyne, resolvent, antispasmodic, emollient; bronchial affections. Dose, ʒj–2 (4–8 Gm.); 1. *Species Pectorales*, 10 p. c. Fomentation, Infusion.

4. *Ses'amum in'dicum; Oleum Sesami*, *Sesame Oil*, *Teel Oil*, *Benne Oil*, *N.F.*—Padaliaceæ. The fixed oil obtained from the seeds of one or more cultivated varieties; India, Africa, cult. in S. United States. Annual herb, 1–1.3 M. (3–4°) high, quadrangular, hairy; leaves lanceolate-ovate; flowers campanulate, 4 Cm. ($1\frac{3}{5}$′) long, pale purple; fruit, capsule, 2.5–5 Cm. (1–2′) long, quadrangular, pericarp leathery, olive-green, dehiscent; seed 5 Mm. ($\frac{1}{5}$′) long, testa thick, yellowish, variegated; contain fixed oil 47–56 p. c., proteins 22 p. c., mucilage 4 p. c., ash 4.8 p. c. Oleum Sesami, pale yellow oily liquid; almost odorless, bland taste, slightly acid, slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, sp. gr. 0.918; contains triglycerides of oleic (chiefly) and linoleic acids 75 p. c., also myristin, palmitin, stearin 20–25 p. c., sesamin. Laxative, demulcent, emollient, nutritious; similar to olive oil, but less agreeable and digestible; mostly in hair preparations, liniments; internally in emulsion. Dose, ʒss 2 (15–60 cc.); 1. *Linimentum Ammoniæ*, 75 p. c., + aq. ammon. 25 p. c.; 2. *Olea Infusa*, 100 p. c.

Fig. 373.—*Sesamum indicum*: *a*, flowering branch; *b*, section of seed enlarged.

Allied Products:

1. *Ground-nut*, *Pea-nut Oil* (*Ar'achis hypogæ'a*).—Tropical America; seed contain fixed oil 45 p. c.; used instead of sesame and olive oil.

2. *Soy Oil* (*Glyci'ne* (*So'ja*) *his'pida*), Japan; seed reniform, used as food and for making a sauce (soy); contain bland fixed oil 15–20 p. c. 3. *Ben Oil, Behen Oil* (*Morin'ga ap'tera, M. pterygosper'ma*), E. India; seed called *ben-nuts*, have elongated, membranous wings; yield fixed oil 30 p. c.; used as purgative and in extracting perfume from flowers.

63. RUBIACEÆ. Madder Family.

Ru-bi-a'se-e. L. *Rubi-a* + aceæ, madder, fr. *rubeus, rubere*, red—*i. e.*, referring to color of the roots. Trees, shrubs, herbs. Distinguished by versatility of important uses; stems round or angular; leaves opposite, stipulate, calyx 4–5-toothed, superior; corolla 4–5, regular, epigynous; stamens 4–5, on corolla-tube, anthers 2-celled; ovary inferior, 2–4-celled; fruit inferior, dry or succulent, edible, 2-celled; seeds 1 or more in each cell; temperate climates, tropics; tonic, febrifuge, astringent, emetic, purgative, diuretic, emmenagogue, dyeing, tanning, poisonous.

Genera: **1. Cinchona. 2. Ourouparia. 3. Coffea. 4. Cephaëlis.**

CINCHONA. CINCHONA, *U.S.P.*

Cinchona	**succirubra,** + hybrids, *Pavon,* **Ledgeriana,** + hybrids, *Moens,* **Calisaya,** + hybrids, *Weddell,* and other species.	The dried bark yielding not less than 5 p. c. alkaloids.

Habitat. S. America; cultivated in Java, India, Ceylon, E. Africa, Straits Settlements; unsuccessfully in Brazil, Jamaica, Mexico, Fijis, etc.

Syn. Jesuit Bark (Powder), Countess' Powder; 1. Red Peruvian Bark, Red Bark, Saint Ann's Bark; Br. Cinchonæ Rubræ Cortex; Fr. Quinquina rouge; Ger. Cortex Chinæ, Chinarinde, Rothe Chinarinde. 2, 3. Yellow Cinchona, Calisaya Bark, Yellow Peruvian Bark, Cinchona Flava, Cinchonæ Flavæ Cortex; Fr. Quinquina (Calisaya) jaune; Ger. China Regia, Kalisayarinde, Königschina.

Cin-cho'na, better *Chinchona*, after Countess Ana de Osorio, wife of fourth Count of Chinchon, Spanish Viceroy of Peru (Chinchon, a town in Spain, near Madrid). She was cured of tertian fever by this bark, 1638, through the recommendation of a Jesuit, brought it to Europe, 1640, extolled its virtues, and thus published the hitherto Jesuit secret.

Suc-ci-ru'bra. L. *succus*, juice, + *ruber*, red—*i. e.*, sap first colorless, then white, and red on exposure.

Ledg-er-i-a'na. L. Ledgerian, of or belonging to Ledger—*i. e.*, after C. Ledger, who obtained the seed, 1865, from the Caupolican province, Bolivia.

Cal-i-sa'ya. Name given the bark by Spaniards and Indians.

Quina (Gheena), Peruv. Indian name for bark; *quina-quina*—medicinal bark; this name they apply also to other barks, and from it comes Fr. Quinquina rouge; Ger. China, very similar to Sp. *cascarilla*, dim. of *cascara*.

Plants.—Evergreen trees, 6–24 M. (20–80°) high, .1–.6 M. (4–24′) thick; leaves opposite, entire, caducous, bright green, shining, glabrous above, paler, pubescent beneath (best scrobiculate, except *C. succirubra*), lamina 7.5–20 Cm. (3–8′) long, 2.5–7.5 Cm. (1–3′) broad, ovate, midrib prominent often purplish, petiole pubescent, reddish; flowers tubular, pinkish, fragrant, 15 Mm. ($\frac{3}{5}$′) long, 5-divided; fruit dehiscent

capsule, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}$′) long, ovate, smooth, 2-celled, seeds winged, numerous. BARK, quills, curved pieces, broken fragments, 2–8 Mm. ($\frac{1}{12}$–$\frac{1}{3}$′) thick, brown, reddish-brown, usually with white or gray lichens, corky ridges, protuberances, transverse fissures, rarely numerous or much intersected and with sloping sides (Red), or with numerous intersecting transverse and longitudinal fissures with nearly vertical

FIG. 374.—*Cinchona succirubra.*

sides (Yellow); inner surface brown, reddish-brown, striate; fracture short, granular (outer), splintery (inner); odor faintly aromatic; taste astringent; very bitter. POWDER, brown—bast-fibers spindle-shaped, with thick lignified lamellated walls having pores, parenchyma and cork brown; starch grains up to .02 Mm. ($\frac{1}{1250}$′), minute spheroidal microcrystals. *Test:* 1. Heat 1 Gm. in dry test-tube—bright red

distillate (*C. succirubra*), or—tarry distillate, purplish, granular (*C. Ledgeriana* + *C. Calisaya*). *Solvents:* 75 p. c. alcohol; acidified water. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—Inferior grades through ignorance, substituting one variety for another intentionally, Maracaibo for the yellow; barks treated with ammonia gas (thereby producing cinchona-red) for red bark; powder with residual inferior barks.

Commercial.—Plants natively hug mountain sides; in S. America from 10° north latitude to 20° south latitude, on the eastern slopes of central Andes chain (Bolivia to Peru, Ecuador) and western Cordilleras chain, thence to the highlands of Colombia, Venezuela, Caracas, and Caribbean Sea. Of the 36 species recognized, the 3 official with their hybrids are considered the richest alkaloid producers, that upon which value depends. Formerly the slight variation in color of the bark and specific district sufficed to impress trade importance, but this now turns solely upon assay, making the following classification largely of historic interest: 1, *Red* (*C. succirubra*); 2, *Yellow* (*C. Ledgeriana, C. Calisaya*); 3, *Pale* (*Crown, Loxa—C. officinalis,* var. (*a*) *Condamin'ea,* (*b*) *Bonplan'da,* (*c*) *cris'pa;* 4, *Gray* (*C. nit'ida, C. micrantha, C. peruviana*); 5, *Colombian* (*C. pitayensis, C. lancifo'lia, C. cordifolia*). The best species flourish where mean annual temperature is 13° C. (55° F.) and rainy season continues 9 months, rainfall being heavy at night with intermingled fog and sunshine during the day—the other 3 months (Jan., Feb., March) having nights frequently below freezing and days 24° C. (75° F.) with dense fogs; inferior species thrive where moisture is less uniform and average temperature 20° C. (68° F.). Valleys, owing to locations having to be well-drained, are not so desirable as forest slopes, where trees grow singly or few together at an elevation of 1500–2400 M. (5000–8000°); *C. barbacœn'cis*—most worthless species, so low as 100 M. (330°), while *C. succirubra* is valuable at 700 M. (2300°), and others do well at 3500 M. (11500°). Their area is limited to within 11 degrees north and south of Loja (Loxa), outside of which barks are almost worthless, the most southern being *C. austra'lis,* the most northern *C. tucujen'sis* and *C. cordifolia.* The alkaloids reside largely in the cork and bast-layer of old bark, while that of young bark contains absolutely none; the root-bark of all species is the richest, that of the branches the poorest.

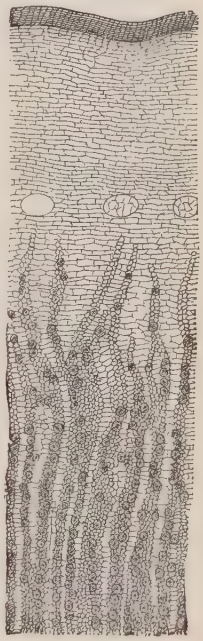


FIG. 375.—*Cinchona succirubra:* transverse section of bark, magnified 30 diam.

Cultivation.—Cinchona trees, growing natively in mountain forests along with bamboos, begonias, coca, fuchsias, orchids, palms, tree ferns,

etc., mostly unprotected and without owners, became, as a rule, common property and a prey to mercenary parties having little regard for future production; with increasing demand and decreasing supply it was only a question of time when the destruction would be complete, a condition that naturally aroused the concern of medical and other scientific men. Although the natives guarded jealously their indigenous inheritance, early endeavoring to prevent its transplanting through foreign visitation and interests, yet it was surmised correctly that the plant would flourish anywhere under approximate climatic conditions. La Condamine first attempted the experiment with failure in 1737;

Fig. 376.—Calisaya bark, showing digital furrow and short fibrous fracture.

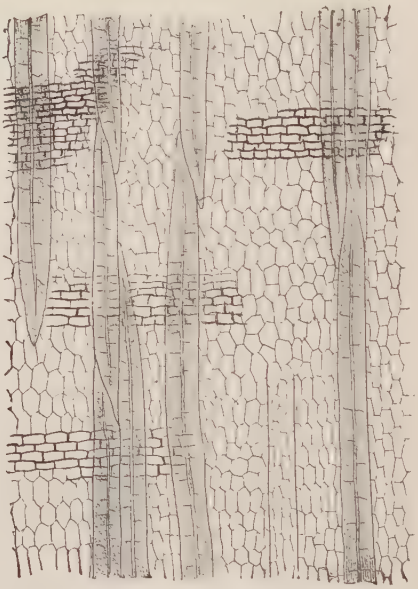


Fig. 377.—Calisaya bark: radial longitudinal section through liber, showing cinchona bast-fibers, bast-parenchyma, and medullary rays, magnified 60 diam.

Dr. Weddell sent seeds to France, 1846–1847, that yielded only ornamental plants, while Hasskarl and Junghuhn (Dutch) were the first, 1853, to obtain practical results from plants they collected and sent to Batavia. Then followed Markham (English), 1859, Ledger, Spruce, Cross, and others, who in various visits to S. America procured seeds, cuttings and scions which were distributed to India, Ceylon, Java, where now three-fourths of the world's bark is grown by cultivation. In fact the native product is so deficient in alkaloids (2–4 p. c.) that it constitutes only about 5 p. c. (1 p. c. from wild, 4 p. c. from cultivated) of the sum-total annually used, and as all demand is for cultivated tree-bark, its commerce has been revolutionized in quantity,

quality, and price. The genus, Cinchona, hybridizes well, so that species and varieties have been formed yielding 5, 10, 15 p. c. of total

FIG. 378.—*Cinchona succirubra:* natural quill; *d*, transverse section.

alkaloids (red—5–8–11 p. c.), and those yielding only 3–4 p. c. are in S. India and Java, uprooted by whole plantations and replaced by supposed richer hybrids. Propagation by cuttings is slow, so seeds are

FIG. 379.—*Cinchona Calisaya* (young): natural size.

planted in nurseries, scions grafted and transplanted into orchards, which are cared for like cultivated fruit trees. *C. Calisaya*, and *C. Ledgeriana* (by some considered only a variety of the former) are the

FIG. 380.—*Mossed C. officinalis* (Nat.).

FIG. 381.—Cinchona bast-fibers.

species, owing to their richness in quinine, mostly cultivated, the latter largely predominating, while *C. succirubra*, although rich in alkaloids

(chiefly cinchonidine, with some cinchonine and quinidine) is poor in quinine—only 20–40 p. c. of the total, causing its demand to decrease greatly and its cultivation to be practically abandoned. Most of the cultivated bark is grown in Java, considerable in India; formerly a great deal was produced in Ceylon, but a disease fatal to the trees and the substitution of tea-planting have almost eliminated that supply; Bolivia and the Straits Settlements furnish some. When trees are about 15 years old the bark becomes more or less worthless, consequently they are cut down and replaced. The mountains best adapted for this cultivation are Neilgherry, Himalaya, and Blue.

Collection. 1. *Wild S. American Bark.*—Formerly this was collected by gangs of *cascarilleros*, managed for companies by major-domos; each gang left the seacoast in dry weather on donkeys, for the distant mountains, being away several months, and upon arriving in the cinchona districts, encamped near a stream, planted corn and beans, built huts, and depended upon game for meat. Having with a mallet loosened, then removed the lower trunk-bark, the tree was felled and stripped entirely of bark, which was carried to the huts and, in the sun or under shelter, allowed to dry in quills or pieces pressed flat by rocks, and when dried, the best was put in canvas bundles (150 pounds; 70 Kg.) and the return trip begun. At the coast ports these bundles were sewed up in fresh hides, forming, when dry, tight seroons, which were shipped as such, or in bales or boxes, from Guayaquil, Payta, Lima, Carthagena, Santa Marta, Buenos Ayres, etc. Bolivia is the only local country in which the trees are cultivated.

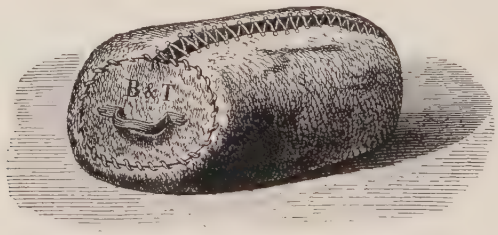


Fig. 382.—Cinchona seroon.

2. *Cultivated India Bark.*—This is cared for and collected in several ways: 1, *Uprooting*, which consists in pulling up and barking the whole tree and replanting the ground—the bark of each tree-part being marketed separately; 2, *Coppicing*, mostly practised, and consists in felling the trees, allowing shoots to spring from the stumps, and collecting the bark as soon as "ripe," when plants 6–9 years old and trunks 15–20 Cm. (6–8′) thick—as such furnishing when in quills, "Druggists' bark," or when broken up and compressed to save transportation charges, "Manufacturers' bark," being purchased upon assay-unit, each unit corresponding to 1 p. c. of quinine in a pound (.5 Kg.); 3, *Shaving* (*Scraping*), which consists of shaving off with drawing-knives

the outer bark of plants 3–5 years old, leaving intact the liber, upon which another growth of richer bark soon forms; 4, *Mossing*, which consists of taking off yearly alternating strips of bark and covering the decorticated portion with moss, grass, straw, hay, rags, paper, etc., thereby giving an annual yield of rich bark (*mossed, renewed*) during the tree's entire life. Bark thus covered is stronger in alkaloids, as it prevents the sun converting the alkaloids into coloring matter, especially on the side exposed to direct rays (most quinine and quinidine in bark from trees grown in mid-woods (shade), most cinchonidine and cinchonine from trees exposed to sun). The last two methods not only furnish richest bark, but also replace it rapidly, at the same time they are attended with the drawback of exposing new-forming bark-cells to the attack of stag-beetles, ants, etc.; most alkaloids, especially quinine, are stored in outer bark fibers, but the purest in cellular tissue of inner bark. The average annual exportation of cinchona bark is about as follows: Java 14,726,000 pounds (6,693,190 Kg.); India 1,020,000 pounds (63,640 Kg.); Ceylon 407,000 pounds (185,000 Kg.); S. America 775,000 pounds (352,273 Kg.); Africa 178,872 pounds (81,305 Kg.). Most of the cultivated bark is in quills, whereas most of the wild-grown was in large pieces (*tabla*), thereby rendering examination easy.

CONSTITUENTS.—From 21–32 natural alkaloids: Quinine, Quinidine, Cinchonine, Cinchonidine, Quinamine, Chinoidine, (Conquinamine, Cupreine, Homoquinine, Hydroquinine, Paytine, Concusconine, etc.); 8 artificial alkaloids: Quinicine, Cinchonicine, Quinamicine, Apoquinamine, etc., Quinic acid, Quinovic acid, Cincho-tannic acid, Quinovin, Cinchona-red, volatile oil, resin, starch, gum, sugar, wax, calcium oxalate, ash 1–3 p. c.

The first 4 alkaloids are the most important, and can be obtained by mixing a concentrated infusion of cinchona with milk of lime, whereby this latter combines with the acids and coloring matter, thus liberating the alkaloids; now strain, and exhaust the residue with boiling alcohol (benzin, kerosene), acidify with sulphuric acid, treat with animal charcoal, filter, and while hot neutralize with sodium hydroxide V. S., when quinine sulphate crystallizes out; to the mother-liquor add large excess of ammonia water, which precipitates cinchonine and cinchonidine, while quinidine remains in solution; dissolve the precipitate in boiling alcohol, and upon cooling cinchonine separates; by evaporating the two remaining solutions we get on the one hand cinchonidine, and on the other quinidine. The respective salts may be prepared by dissolving the several alkaloids in water, adding sufficient of the desired acid for neutralization, allowing to crystallize.

Quinina, Quinine, $C_{20}H_{24}O_2N_2.3H_2O$, *U.S.P.*—(Syn., Quin., Chininum; Fr. Quinine; Ger. Chinin.) This alkaloid, obtained from the bark of various cinchona species, may be prepared by precipitating a solution of quinine sulphate in acidified water with an alkali, thereby yielding the anhydrous, white, curdy, amorphous alkaloid, which by

being kept under water changes to the crystalline form. It is a white, microcrystalline powder, odorless, bitter taste which is intense and persistent, efflorescent, soluble in water (1560), boiling water (800), alcohol (.8), chloroform (1.1), ether (1.9), ammonia water (1890); alcoholic solution (1 in 10) levorotatory, alkaline; solution in sulphuric acid—vivid blue fluorescence. *Tests:* 1. Aqueous solution (1 in 100) 1 cc. + diluted sulphuric acid to dissolve, + ammonia water 1 cc., + 2–3 drops of bromine T.S.—emerald-green color (thalleioquin). 2. Dry to constant weight—loses not more than 15 p. c. (water); incinerate—ash .1 p. c. 3. .1 Gm. + sulphuric acid 2 cc.—not darker than light yellow (abs. of readily carbonizable substances). 4. .2 Gm. + sodium hydroxide T. S. 2 cc., heated on a water-bath—no odor of ammonia (abs. of ammonium salts). *Impurities:* Ammonium salts, water, other cinchona alkaloids, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, 1–20 (.06–1.3 Gm.).

Quininæ Bisulphas, Quinine Bisulphate, $C_{20}H_{24}O_2N_2.H_2SO_4.7H_2O$, *U.S.P.*—(Syn., Quin. Bisulph., Quininæ Acid Sulphate; Fr. Sulfate acide (Bisulfate) de Quinine (neutre); Ger. Chininum bisulfuricum, Saures Chininsulfat.) This acid sulphate is obtained by dissolving neutral quinine sulphate (100) in warm distilled water (500) + diluted sulphuric acid (115), setting aside to crystallize. It is in colorless, transparent, whitish, orthorhombic crystals or small needles, odorless, very bitter taste, efflorescent, yellow on exposure to light, soluble in water (9), boiling water (.7), alcohol (23), hot alcohol (.7), glycerin (15), chloroform (625), ether (2500). *Tests:* 1. With barium chloride T. S.—white precipitate insoluble in hydrochloric acid; also responds to those under Quinina; dry to constant weight—loses not more than 24 p. c.; incinerate—ash .05 p. c. *Impurities:* Ammonium salts, other cinchona alkaloids, water, inorganic salts, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.).

Quininæ Dihydrochloridum, Quinine Dihydrochloride, $C_{20}H_{24}O_2N_2.2HCl$, *U.S.P.*—(Syn., Quin. Dihydrochl., Quinine Bimuriate; Br. Quininæ Hydrochloridum Acidum, Acid Quinine Hydrochloride; Fr. Chlorhydrate acide de Quinine; Ger. Chininum dihydrochloricum, Chinindihydrochlorid.) Obtained by dissolving quinine hydrochloride (10) in distilled water (20), adding 25 p. c. hydrochloric acid (3.7), crystallizing; may also be made by double decomposition between quinine bisulphate and barium chloride. It is a white powder, odorless, very bitter taste, soluble in water (.6), alcohol (12), slightly in chloroform, very slightly in ether; aqueous solution (1 in 20) strongly acid. *Tests:* 1. Aqueous solution (1 in 20) with silver nitrate T. S.—white precipitate, insoluble in nitric acid but soluble in ammonia T. S.; also responds to those under Quinina: dried to constant weight—loses not more than 3 p. c.; incinerate—ash .05 p. c. *Impurities:* Barium sulphate, readily carbonizable substances, water, other cinchona alkaloids. Should be kept dark, in well-closed containers. Owing to great solubility very

valuable hypodermically—whooping-cough of children, etc. Dose, gr. 1–20 (.06–1.3 Gm.); child, gr. 1–5 (.06–.3 Gm.), 25 p. c. solution; 1. *Ampullæ Quininæ Dihydrochloridi, N.F.*, 8.5 gr. (.55 Gm.). Dose, 1–2 ampuls.

Quininæ Æthylcarbonas, Quinine Ethylcarbonate, $C_{20}H_{23}O_2N_2.CO_2.C_2H_5$, *U.S.P.*—(Syn., Quin. Æthylcarb., Euquinine; Fr. Æthylcarbonate de Quinine; Ger. Æthylkohlensäurechininester, Euchinin.) Obtained by passing carbonyl chloride (phosgene) into dehydrated alcohol, rectifying resulting chlorocarbonic ester, which then acts upon solution (ether) of anhydrous quinine; purified by washing and crystallizing. It is in white, fine soft needles, usually matted in fleecy masses, odorless, practically tasteless, but masticated slowly develops slight bitterness, darkens on exposure, soluble in alcohol (2), chloroform (1), readily in dilute acids, slightly in water; melts at 90° C. (194° F.); aqueous solution slightly alkaline, solution in diluted sulphuric acid—blue fluorescence. *Tests:* 1. To aqueous solution (1 in 1000) 5 cc., made with diluted sulphuric acid, add 2–3 drops of bromine T. S., + 1 cc. ammonia T. S.—green-colored liquid (thalleioquin). 2. Warm .2 Gm. with 2 cc. sodium hydroxide T. S., + 5 cc. iodine T. S.—odor of iodoform; incinerate—ash .2 p. c. *Impurities:* Chloride, sulphate, water. Should be kept dark, in well-closed containers. Dose, gr. 1–30 (.06–2 Gm.).

Quininæ Hydrobromidum, Quinine Hydrobromide, $C_{20}H_{24}O_2N_2.HBr.H_2O$, *U.S.P.*—(Syn., Quin. Hydrobr., Quinine Bromide, Quininæ Hydrobromas; Fr. Bromhydrate de Quinine (basique); Ger. Chininhydrobromat, Bromwasserstoffsaures Chinin.) Obtained by dissolving quinine (alkaloid) in warm diluted hydrobromic acid, neutralizing, crystallizing; may also be made by double decomposition between quinine sulphate and barium bromide, in hot water. It is in white, light, small needles, scale-like crystals; odorless, very bitter taste, efflorescent, soluble in water (40), hot water (3.2), alcohol (1), glycerin (7), chloroform (.6), ether (23); aqueous solution (1 in 50) neutral, slightly alkaline; with excess of diluted sulphuric acid—vivid blue fluorescence. *Tests:* 1. To aqueous solution (1 in 50) 5 cc. add sodium hydroxide T. S. 1 cc., heat, cool, filter, acidulate with dilute hydrochloric acid, add chloroform 1 cc. + few drops of chlorine T. S., shake gently—chloroform reddish-brown color; also responds to those under Quinina; dried to constant weight—loses not more than 5 p. c.; incinerate—ash .05 p. c. *Impurities:* Barium, other cinchona alkaloids, water, inorganic salts, readily carbonizable substances. Should be kept dark, in well-closed containers Dose, gr. 1 20 (.06–1.3 Gm.).

Quininæ Hydrochloridum, Quinine Hydrochloride, $C_{20}H_{24}O_2N_2.HCl.2H_2O$, *U.S.P.*—(Syn., Quin, Hydrochl., Quinine Chloride, Quininæ Hydrochloras, Muriate of Quinine; Fr. Chlorhydrate de Quinine (basique); Ger. Chininum hydrochloricum, Chininhydrochlorid, Salzsaures Chinin.) Obtained by dissolving quinine in warm diluted hydrochloric acid until solution neutral, crystallizing; or by double

decomposition of quinine sulphate and barium chloride, in hot water. It is in white, silky, glistening needles, odorless, very bitter taste, efflorescent, soluble in water (16), hot water (.5), alcohol (.8), glycerin (7), chloroform (.7), ether (340); aqueous solution (1 in 25) neutral, slightly alkaline, non-fluorescent, except when highly diluted or diluted sulphuric acid added. *Tests:* 1. Aqueous solution (1 in 20) with silver nitrate T. S.—white precipitate, insoluble in nitric acid, but soluble in ammonia T. S.; also responds to those under Quinina; dried to constant weight—loses not more than 10 p. c.; incinerate—ash .05 p. c. *Impurities:* Barium, other cinchona alkaloids, water, inorganic salts, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.); 1. *Elixir Ferri, Quininæ et Strychninæ, N.F.*, .875 p. c. 2. *Syrupus Phosphatum cum Quinina et Strychnina, N.F.*, .44 p. c. Dose, each ℥j–2 (4–8 cc.). 3. *Tinctura Antiperiodica, N.F.*, 1.5 p. c.

Fig. 383.—Quinine sulphate: microscopic crystals.

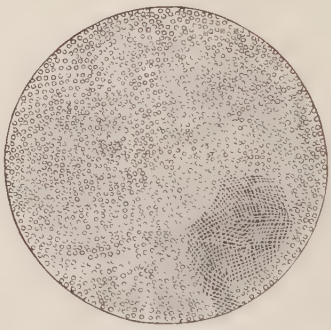


Fig. 384.—Quinine sulphate with KSCN: microscopic granules.

Quininæ Sulphas, Quinine Sulphate, $(C_{20}H_{24}O_2N_2)_2.H_2SO_4.7H_2O$, *U.S.P.* —(Syn., Quin. Sulph., Quininæ Sulphas, Sulfas Quinicus; Fr. Sulfate de Quinine (basique); Ger. Chininum sulfuricum, Chininsulfat, Schwefelsaures Chinin.) Obtained by exhausting powdered bark with acidified water (HCl, H_2SO_4), precipitating with an alkali, or by mixing powdered bark with milk of lime, dissolving out alkaloids with petroleum oil, treating with diluted sulphuric acid, neutralizing with sodium carbonate, crystallizing. It is in white, silky, light, flexible, glistening crystals, making a very light, easily compressible mass, or hard, prismatic, monoclinic needles, odorless, persistent, very bitter taste, efflorescent (rapidly), becoming lusterless, brownish on exposure, soluble in water (725), hot water (47), alcohol (107), hot alcohol (12), glycerin (30), slightly in chloroform, ether, freely in a mixture of chloroform (7) and dehydrated alcohol (4); saturated aqueous solution neutral, slightly alkaline; with diluted sulphuric acid—vivid blue fluorescence. *Tests:* 1. Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid; also responds to

those under Quinina; dried to constant weight—loses not more than 16.2 p. c.; incinerate—ash .05 p. c. *Impurities:* Other cinchona alkaloids, water, inorganic salts, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 1–20–40 (.06–1.3–2.6 Gm.).

Most of the world's supply of quinine is produced by 20 factories: France—5, America—4, England—3, Germany—2, Italy—2, Bengal, Holland, Java, Madras Presidency, each—1; the average annual Asiatic output is about: Madras—15.711 pounds (7.141 Kg.), Bengal—11.297 pounds (5.135 Kg.), Java—43.750 pounds (19.886 Kg.).

FIG. 385.—Quinidine sulphate with KSCN: microscopic crystals.

FIG. 386.—Cinchonine sulphate with KSCN: microscopic crystals.

Quininæ Tannas, Quinine Tannate, $C_{20}H_{24}O_2N_2.3C_{14}H_{10}O_9.8H_2O$, *U.S.P.*—(Syn., Quin. Tan., Tasteless (Neutral) Quinine; Fr. Tannate de Quinine; Ger. Chininum tannicum, Chinintannat, Gerbsaures Chinin.) Obtained by dissolving quinine sulphate (9) in water (225), + 16 p. c. sulphuric acid (10), adding to filtrate tannic acid (21) + sodium bicarbonate (3.5) dissolved in water (250), washing precipitate, drying, pulverizing. It is a pale yellow, yellowish-white, amorphous powder, odorless, tasteless, slightly bitter, astringent taste, slightly soluble in water, chloroform, ether, somewhat more so in alcohol; melts to purplish, viscous mass; contains 30 35 p. c. of anhydrous quinine, composition being somewhat varying. *Tests:* 1. Aqueous or alcoholic solution with ferric chloride T. S.—blue-black color; dry to constant weight—loses not more than 10 p. c.; incinerate—ash .3 p. c. *Impurities:* Uncombined quinine, chloride, sulphate, water, heavy metals. Should be kept dark, in well-closed containers. Dose, gr. 1–10 (.06–.6 Gm.); excellent for children in diarrhea, whooping-cough, but too insoluble as an antiperiodic—in syrup, mucilage, chocolate (quinine chocolates); troches 1 gr., +.

Quininæ et Ureæ Hydrochloridum, Quinine and Urea Hydrochloride, $C_{20}H_{24}O_2N_2.HCl.CO(NH_2)_2.HCl.5H_2O$., *U.S.P.*—(Syn., Quin. et Urea. Hydrochl., Quinine and Urea Chloride, Carbamidated Quinine Dihy-

drochloride; Fr. Chlorhydrate de Quinine et de Urée; Ger. Chinin-Harnstoff Hydrochlorid, Chininum bimuriaticum carbamidatum.) Obtained by dissolving quinine hydrochloride (400) in diluted hydrochloric acid (800), mixing solution with urea, $CO(NH_2)_2$, (58), warming until dissolved, filtering through glass wool, crystallizing, washing crystals, drying. It is in colorless, translucent prisms, white, granular powder, odorless, very bitter taste, permanent, soluble in water (.9), alcohol (2.4); aqueous solution (1 in 20) strongly acid; contains 58 p. c. of anhydrous quinine. *Tests:* 1. To a cold solution of 1 Gm. in 2 cc. of distilled water add 2 cc. of nitric acid, cool to 0° C. (32° F.)—leaflets of urea nitrate on standing; after draining dissolve in little distilled water, + few drops of mercuric nitrate T. S. + sodium hydroxide T. S.—white precipitate. 2. Aqueous solution with silver nitrate T. S.—white precipitate, insoluble in nitric acid; incinerate—ash .05 p. c. *Impurities:* Ammonium compounds, readily carbonizable substances, other cinchona alkaloids. Should be kept dark, in well-closed containers. Dose, gr. 1–20 (.06–1.3 Gm.); very effective in malaria; anesthetic like cocaine, locally for operations, chiefly hypodermically, one dose daily, in 50 p. c. solution; 1. *Ampullæ Quininæ et Ureæ Hydrochloridi, N.F.*, 8.5 gr. (.55 Gm.). Dose, 1–2 ampuls.

Quinidina, Quinidine, $C_{20}H_{24}O_2N_2$, *N.F.*—An alkaloid isomeric with quinine. It is in acicular white crystals, amorphous white powder, crystallizing from alcohol in monoclinic prisms with 1 molecule of alcohol, fluorescent, dextrorotatory, alkaline, soluble in alcohol (32), ether (53), chloroform (1.5), slightly in petroleum benzin, almost insoluble in water; odorless, intense persistent bitter taste. *Tests:* 1. Aqueous solution (1 in 1000) 10 cc., + few drops of bromine T. S., made with sufficient diluted sulphuric acid, + ammonia water in slight excess—liquid emerald-green. 2. Dissolve .5 Gm. in distilled water with least possible sulphuric acid, + 5 Gm. of potassium iodide in 5 cc. distilled water, shake slightly, cool to 15° C. (59° F.) for an hour, stirring occasionally—white precipitate (dif. from quinine); forms numerous salts. *Impurities:* Quinine, other cinchona bases. Dose, gr. 1–30 (.06–2 Gm.): 1. *Syrupus Quinidinæ, Bitterless Syrup of Quinidine,* 3.3 p. c.

Quinidinæ Sulphas, Quinidine Sulphate $(C_{20}H_{24}O_2N_2)_2.H_2SO_4.2H_2O$. *U.S.P.*—(Syn., Quinidin. Sulph.; Fr. Sulphate de Quinidine; Ger. Chinidin Sulfas.) Obtained by dissolving quinidine in water, aided by sulphuric acid, and crystallizing. It occurs as fine, needle-like, white crystals, frequently masses, odorless, very bitter, darkens on exposure, soluble in water (90), hot water (15), alcohol (10), soluble in chloroform, almost insoluble in ether, aqueous solution (1–100) neutral or slightly alkaline, dextrorotatory (dif. from quinine sulphate). *Tests:* 1. Aqueous solution (1 in 1000) + sulphuric acid—vivid blue fluorescence, + 1–2 drops bromine T. S., + ammonia T. S. 1 cc.—emerald-green (thalleioquin). 2. Add silver nitrate T. S. 1 cc. to 5 cc. aqueous solution (1 in 100), stir with rod—white precipitate (dif. from

many other alkaloids). 3. With barium chloride T. S.—white precipitate insoluble in hydrochloric acid (sulphate). *Impurities:* Other cinchona alkaloids, water, readily carbonizable substances, ammonium and other inorganic salts. Should be kept dark, in well-closed containers. Dose, gr. 1–8 (.06–.5 Gm.).

Cinchonina, Cinchonine, $C_{19}H_{22}ON_2$.—It is in white lustrous prisms or needles, odorless, at first nearly tasteless, becoming bitter, soluble in alcohol (116), water (3760), chloroform (163), ether (526), no residue, precipitated from acid solution by ammonia water by which it is dissolved sparingly, but soluble in 300 parts of ether (dif. from quinine, quinidine, cinchonidine). Dose, gr. 1–30 (.06–2 Gm.).

Cinchoninæ Sulphas, Cinchonine Sulphate $(C_{19}H_{22}ON_2)_2.H_2SO_4.2H_2O$, *N. F.*—The sulphate of the preceding alkaloid. It is in white lustrous prismatic crystals; odorless, very bitter taste, permanent; soluble in water (60), alcohol (12.5), chloroform (47), ether (3230), hot water (33), hot alcohol (7); saturated aqueous solution neutral or slightly alkaline, dextrorotatory. *Tests:* 1. Aqueous solution (1 in 100) with barium chloride T. S.—white precipitate insoluble in hydrochloric acid. 2. Shake .1 Gm. with chloroform 10 cc.—dissolves (abs. of quinine or cinchonidine sulphate); incinerate—ash .1 p. c.; solution (1 in 1000) in diluted sulphuric acid—only slight blue fluorescence. *Impurities:* Quinine or cinchonidine sulphate, readily carbonizable organic substances. Dose, gr. 1–30 (.06–2 Gm.); 1. *Elixir Cinchonæ Alkaloidorum,* $\frac{1}{10}$ p. c.: same, *et Ferri,* or *Ferri et Bismuthi,* or *Ferri, Bismuthi et Strychninæ.* Dose, each, ʒj–2 (4–8 cc.).

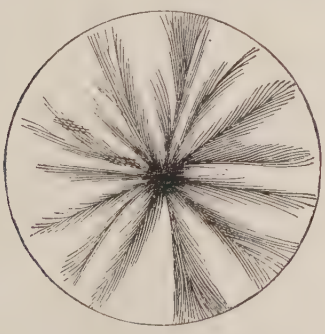


Fig. 387

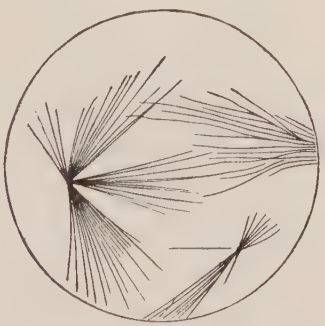


Fig. 388

Figs. 387, 388.—Cinchonidine sulphate with KSCN: microscopic crystals.

Cinchonidina, Cinchonidine, $C_{19}H_{22}ON_2$.—This is non-fluorescent, isomeric with cinchonine; with chlorine or bromine water + ammonia water—white color or precipitate; soluble in alcohol (20), ether (188), water (1600), precipitated from its associated alkaloids by sodium tartrate. Dose, gr. 1–30 (.06–2 Gm.).

Cinchonidinæ Sulphas, Cinchonidine Sulphate, $(C_{19}H_{22}ON_2)_2.H_2SO_4.3H_2O$, *U.S.P.*—(Syn., Cinchonid. Sulph.; Fr. Sulfate de Cinchonidine

(basique); Ger. Cinchonidinum sulfuricum, Cinchonidinsulfat.) It is in white, glistening, silky needles, prisms, permanent, odorless, very bitter taste, soluble in water (65), hot water (22), alcohol (90), warm alcohol (41), chloroform (620), nearly insoluble in ether; saturated aqueous solution neutral, faintly alkaline, levorotatory; when anhydrous melts at 200° C. (392° F.) with partial decomposition. *Tests:* 1. Aqueous solution + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. 2. Aqueous solution (1 in 100) + ammonia T. S.—white precipitate (cinchonidine), slightly soluble in ammonia T. S. or in ether; aqueous solution (1 in 100) + sodium tartrate T. S.—white precipitate of cinchonidine tartrate (dif. from cinchonine). 3. Dry to constant weight—loses 12 p. c.; incinerate 1 Gm.—ash .1 p. c.; solution in diluted sulphuric acid (1 in 1000)—faint blue fluorescence (abs. of quinine, quinidine). *Impurities:* Cinchonine or quinidine sulphate, readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 1–30 (.06–2 Gm.); 1. *Elixir Cinchonæ Alkaloidorum*, $\frac{1}{10}$ p. c.: same, *et Ferri*, or *Ferri et Bismuthi*, or *Ferri, Bismuthi et Strychninæ.*

Quinami(n)a, Quinamine, $C_{19}H_{24}O_2N_2$.—In long white prisms, nonfluorescent, nearly tasteless, acid solution very bitter, soluble in ether, hot alcohol.

Chinoidinum, Chinoidin, Quinoidin; U.S.P. 1880.—A blackish amorphous alkaloid, resulting from evaporation of mother-liquor of the preceding alkaloids, and precipitating with sodium hydroxide—purify by dissolving in dilute hydrochloric acid, precipitating by ammonia, washing, drying; it is one-half the strength of quinine. Dose, gr. 2–30 (.13–2 Gm.).

Quinic Acid (Kinic, Chinic or Cinchonic), $C_7H_{12}O_6$.—5–9 p. c.

Quinovic Acid (Kinovic), $C_{32}H_{48}O_6$.—Tasteless shining crystals.

Cincho-tannic Acid (Quino-tannic), $C_{14}H_{16}O_9$.—3–4 p. c.

The alkaloids are combined with one or more of these acids; the first acid (quinic) with sulphuric acid and manganese dioxide yields kinone, $C_6H_4O_2$; the first and second (quinic and quinovic) produce quinates (kinates) and quinovates (kinovates), as quinate (kinate) of quinine, lime, etc.; the last (cincho-tannic) is a glucoside, being the soluble red coloring matter; when boiled with sulphuric acid gives sugar and cinchona-red.

Quinovin (Kinovin, Chinovin, Quinovic Bitter), $C_{30}H_{48}O_8$.—Bitter glucoside; to alcoholic solution add hydrochloric acid gas, get quinovic (kinovic) acid and quinovin (kinovin) sugar (mannitan).

Cinchona-red, $C_{28}H_{22}O_{14}$.—This is from cincho-tannic acid, soluble in alcohol and alkaline solutions. Red cinchona bark may contain 10 p. c.

PREPARATIONS. — BARK: 1. *Fluidextractum Cinchonæ.* Fluidextract of Cinchona. (Syn., Fldext. Cinchon., Fluid Extract of Cinchona, Fluidextract of Calisaya Bark; Br. Extractum Cinchonæ Liquidum; Fr. Extrait fluide de Quinquina jaune; Ger. Extractum Chinæ fluidum, Chinafluidextrakt, Kalisayarindenfluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st menstruum: alcohol 80 cc., glycerin 10, hydrochloric acid 10; 2d menstruum: 80 p. c. alcohol; after dissolving soft extract in the reserve, assay, and add enough 80 p. c. alcohol for the 100 cc. to contain 4–5—4.5 Gm. of alkaloids. Dose, ♏xv–60 (1–4 cc.).

2. *Tinctura Cinchonæ.* Tincture of Cinchona. (Syn., Tr. Cinch., Tincture of Yellow Cinchona—Peruvian Bark, Tinctura Cinchonæ Flavæ; Fr. Teinture de Quinquina (jaune); Ger. Tinctura Chinæ, Chinatinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104; 1st menstruum: glycerin 7.5 cc., alcohol 67.5 cc., water 25 cc., percolate, finish with 67 p. c. alcohol, and adjust with same for the 100 cc. to contain .8–1—.9 Gm. of alkaloids. Dose, ℥j–2 (4–8 cc.).

3. *Tinctura Cinchonæ Composita.* Compound Tincture of Cinchona. (Syn., Tr. Cinch. Co., Huxham's Tincture of Bark; Compound Tincture of Peruvian Bark; Fr. Teinture de Quinquina composée, Elixir fébrifuge d'Huxam; Ger. Tinctura Chinæ composita, Zusammengesetzte Chinatinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; using cinchona 10 Gm., bitter orange peel 8, serpentaria 2; 1st menstruum: glycerin 7.5 cc., alcohol 67.5 cc., water 25 cc., percolate 95 cc., assay, and add enough 67 p. c. alcohol for the 100 cc. to contain .4–.5—.45 Gm. of total alkaloids. Dose, ℥j–2 (4–8 cc.).

Prep.: 1. *Gargarisma Guaiaci Compositum, N.F.,* 10 p. c.

Quinine: 1. *Oleatum Quininæ, N.F.,* 25 p. c. + oleic acid 75. 2. *Syrupus Ferri, Quininæ et Strychninæ Phosphatum, N.F.,* 2.6 p. c. 3. *Liquor Hypophosphitum Compositus, N.F.,* $\frac{1}{5}$ p. c. 4. *Syrupus Hypophosphitum Compositus, N.F.,* $\frac{1}{10}$ p. c. Dose, each, ℥j–2 (4–8 cc.).

Quinine Sulphate: 1. *Elixir Cinchonæ Alkaloidorum, N.F.,* $\frac{1}{5}$ p. c. + cinchonidine sulph. $\frac{1}{10}$ p. c., cinchonine sulph. $\frac{1}{10}$ p. c.,+. 2. *Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, N.F.,* .875 p. c. Dose, each, ℥j–2 (4–8 cc.). 3. *Pilulæ Antiperiodicæ, N.F.,* $1\frac{1}{2}$ gr. (.09 Gm.). 4. *Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, N.F.,* 1 gr. (.06 Gm.). 5. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N.F.,* 1 gr. (.06 Gm.). 6. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, N.F.,* 1 gr. (.06 Gm.). 7. *Pilulæ Opii, Digitalis et Quininæ, N.F.,* 1 gr. (.06 Gm.). Dose, each, 1 pill.

Unoff. Preps.—Bark: *Extract* (75 p. c. alcohol), gr. 5–15 (.3–1 Gm. *Decoction, Infusion,* each, 6 p. c., + aromatic sulphuric acid 1 p. c., ℨss–2 (15–60 cc.). *Fluidextract* (aqueous), cinchona 100, hydrochloric acid 3, glycerin 12.5, water 500, + water q. s. Quinine: *Wine,* $\frac{1}{4}$ p. c., ℨss–1 (15–30 cc.). Various salts.

Properties.—Tonic, antiperiodic, febrifuge, astringent, stomachic, antiseptic, prevents fermentation and putrefaction. The S. American Indians still consider it poisonous, and always use milder remedies for fevers, while the Ecuador cascarilleros believe their red bark is used only for dyeing. It is thought the Jesuits first discovered its medicinal

properties, and not the natives, hence the name Jesuits' powder, as they sold it for its weight in silver, grain for grain. Sir Robert Talbot cured Charles II. of tertian fever with it, 1679, and then sold the secret to Louis XIV., of France, who published it in 1681. The bark is astringent, the alkaloids are not; small doses increase appetite, saliva, gastric juice, peristalsis, heart action, cerebral functions, excretion of waste products; moderate doses diminish amount of urea, uric and phosphoric acids, interfere with oxygen-carrying function of red and prevent migration of white corpuscles, lessen fever by destroying or rendering inert the infective agent causing it, and by diminishing metabolism in the tissue; large doses depress heart, produce gastric irritation, eructation, chill and fever paroxysms, headache, dizziness, perspiration; also quinine, if taken when not indicated, may produce fever, a sense of constriction about the head, ringing in the ears, vertigo, staggering, deafness, headache, delirium—*cinchonism*. Inasmuch as this will produce that which it cures, Hahnemann, it is said, was influenced by this fact, along with some others, to revive and reëstablish homeopathy as based upon *similia similibus curantur*. Quinidine and cinchonidine are similar to quinine, but cinchonidine produces less marked head symptoms. Cinchonine is the weakest alkaloid, but causes much headache and muscular weakness.

Uses.—Atonic dyspepsia, convalescence, gastric catarrh, asthma, bronchitis, amenorrhea, enlarged spleen.

Quinine as a specific in malaria, acting as a direct poison to the *plasmodium malariæ*, which, infesting the blood, cause the disease. In intermittents give gr. 10 (.6 Gm.) of sulphate in sweating stage, and same quantity 5 hours before the next paroxysm; in the intervals of paroxysms give arsenic; treatment should be preceded by a good purge (calomel), thus rendering the liver more active and the drug more efficacious; absorption is accelerated by hot drinks, or diluted acids. In remittents give gr. 20–30 (1.3–2 Gm.) at a dose, once or twice daily, until temperature reduced. In typhus and typhoid fevers, variola, pneumonia, pyemia, septicemia, neuralgia, scarlet fever, erysipelas, measles, skin affections, whooping-cough, hay fever, to stimulate uterine contraction in labor.

Cinchona bark itself is not much used now, because of its excessive bulkiness, and owing to its alkaloids representing in such a concentrated form the medicinal properties without astringency.

Administration.—The hydrochloride, owing to its greater solubility, is the best salt of quinine for general use, the hydrobromide ranking next; the tannate and sulphate are the most insoluble and possess lower alkaloidal strength, but the latter, in spite of this, is employed mostly. The pill, capsule, or tablet disguises best the taste, but solutions are more effective, and their taste may be modified by ext. glycyrrh., chocolate, glycyrrhizin, yerba santa syrup or fluidextract, etc., in which condition the alkaloid should never be dissolved with acids, but simply suspended by mucilage.

Poisoning: Give potassium bromide and hydrobromic acid, and if associated with quinine will act as preventive; may need cardiac and respiratory stimulants. Morphine counteracts its cerebral action, atropine its nervous, cardiac, and antipyretic effects.

Incompatibles: Agents promoting waste: salts of mercury, copper, zinc, lead; tannin with decoction or infusion; alkalies—alkaline carbonates, alkaline earths, and iodine preparations with the alkaloidal solutions, the latter forming insoluble compounds, and all the rest precipitating them.

Synergists: Constructive agents, iron, salicylic acid, arsenic, eucalyptus, phenol, creosote.

FIG. 389.—*Cinchona scrobiculata* bark.

FIG. 390.—*Cinchona pubescens* bark.

Allied Barks:

1. *Maracaibo* or *Hard Yellow Bark* (*C. cordifo'lia*).—This constitutes nearly all of the wild-grown bark; contains 2.5 p. c. of alkaloids. 2. *Pitaya Bark* (*C. pitayen'sis*).—Smooth, with circular scars, liber reddish cinnamon-brown, splintery, powder brownish-yellow. 3. *Cusco Bark* (*C. pubes'cens*).—Pale brownish-yellow to whitish, warty periderm, liber cinnamon-color, fracture coarse-splintery; contains cuscovatine, cusconadine, cuscamine. 4. *Carthagena Bark* (*C. lancifo'lia* and *C. cordifolia*.—Like the Cusco, only liber is reddish, fracture fibrous. 5. *Lima* or *Huanuco Bark* (*C. peruvia'na, C. nit'ida, C. micran'tha*).—In quills and half-quills. 6. *Huamalies* or *Gray Bark* (*C. micran'tha, C. purpu'rea, C. glandulif'era*).—In ash-gray quills and half-quills. 7. *Jean* or *False Loxa Bark* (*C. Humboldtia'na*).—A very inferior variety.

RUBIACEÆ

Spurious Cinchona Barks:

1. *Cuprea* or *Copper-colored Bark* (*Remij'ia Purdiea'na, R. pedunculata*).—Colombia, Andes; contains alkaloids, 3 p. c.—quinine 2 p.c., the rest being quinidine, cinchonine, quinovin. The quinine exists as homoquinine and cupreine, $C_{19}H_{22}O_2N_2$; this latter is red-brown with ferric chloride, and converted into quinine by methyl chloride.

2. Barks belonging to other genera as *Cascaril'la, Ladenber'gia, Nau'clea, Exostem'ma*, etc. All distinguished by *Grahe's test:* The powdered bark heated in a dry test-tube yields a tarry distillate of red color; this test applies to cuprea bark, but with these genera have no reaction. Some of these barks resemble cinchona, others do not.

GAMBIR. GAMBIR, *U.S.P.*

Ourouparia Gambir, (*Hunter*) *Baillon.*

The dried aqueous extract prepared from the leaves and twigs, yielding not less than 70 p. c. water-soluble extractive, nor less than 60 p. c. alcohol-soluble extractive.

Habitat. E. India Islands.

Syn. Gambier, Terra Japonica; Br. Catechu, Catechu Pallidum, Pale Catechu; Fr. Gambir cubique; Ger. Gambir Catechu, Gutta Gambir.

Ou-rou-pa'ri-a. Native name—*y-ourou-pari*, a Carib. name of the type species, fr. Gr. *οὐρα*, a tail, tailed +,— *i. e.*, the seed.

Gam'bir. Native Malayan name of the extract.

Plant.—Strong shrubby climber, stem woody, often angular; leaves oblong-ovate, 7.5–10 Cm. (3–4′) long, petiolate, acuminate, entire, smooth; flowers small, pinkish, in clusters, calyx and corolla 5-divided, stamens 5, ovary 2-celled; fruit 2.5 Cm. (1′) long, narrow, ovoid tapering at each end, dehiscent, pericarp dry; seed numerous, minute, pale brown, rough, tailed at each end. Extract (gambir), usually in cubical or rectangular masses 20–30 Mm. ($\frac{4}{5}$–$1\frac{1}{5}$′) broad, grayish-, reddish-brown, dull, porous, friable; internally light brown, dark gray color; inodorous; taste bitterish, very astringent. Powder, light brown—masses of acicular crystals, few starch grains, .005–.030 Mm. ($\frac{1}{5000}$–$\frac{1}{833}$′) broad, epidermal fragments, few thick-walled, wavy non-glandular hairs. *Solvents:* water dissolves 65 p. c.; alcohol 60 p. c. Dose, gr. 5–30 (.3–2 Gm.).

Commercial.—The extract is made by boiling young leafy shoots in water for 6 hours, with continued stirring and bruising, evaporating decoction to proper consistency, allowing to cool under constant and peculiar stirring; within half an hour the gambir suddenly contracts and thickens, possibly by the sudden crystallization of the catechin. It is allowed to harden in various forms, the purest in thin cakes, flakes, small cubes. Nearly all exported in wooden cases from Singapore.

Constituents.—Tannic acid 25–38 p. c., Catechin (catechuic acid) 20–29 p. c., ash 9 p. c.

PREPARATIONS.—1. *Tinctura Gambir Composita.* Compound Tincture of Gambir. (Syn., Tr. Gambir Co., Compound Tincture of Pale Catechu; Fr. Teinture de Gambir; Ger. Gambirtinktur.)

Manufacture: 5 p. c. Similar to Tinctura Cardamomi Composita, page 137—using gambir 5 Gm., cinnamon 2.5; menstruum: diluted alcohol q.s. 100 cc. Dose, ʒss–2 (2–8 cc.).

FIG. 391.—*Ourouparia Gambir:* blooming twig with the tendrils.

Prep: 1. *Tinctura Opii et Gambir Composita, N.F.,* 6.4 p. c.

Unoff. Preps.: Fluidextract. Infusion. Pulvis Gambir Compositus, 40 p. c., + kino 20, krameria 20, cinnamon 10, myristica 10, dose, gr. 10–45 –.6–3 Gm.). *Troches,* 1 gr. (.06 Gm.), dose, 1 occasionally.

PROPERTIES.—Similar to tannic acid, astringent, tonic. The darker colored product is most powerful, acting more energetically and harshly than kino.

USES.—Diarrhea, leucorrhea, gonorrhea, cough, chronic sore throat, phthisis, bronchitis, hemorrhages, relaxed uvula, ulcerated nipples, chronic ulcers, relaxed oral mucous membrane and spongy gums (mouth-wash). In the arts—calico printing, dyeing, tanning, as an ingredient in boiler compounds to prevent formation of scaly crusts from certain kinds of water.

CAFFEA. COFFEE.

Caffeina. Caffeine, $C_8H_{10}O_2N_4.H_2O$, *U.S.P.*

Coffea arabica, *Linné,* and **Thea sinensis,** *Linné.* — A feebly basic substance (alkaloid) from the seeds of the former and leaves of the latter (Theaceæ), also occurring in other plants; or prepared synthetically. See page 407.

Habitat. 1. Tropical Africa (Arabia, Abyssinia, Ceylon, Mocha); cultivated in tropical countries (Java, W. Indies, S. America—Brazil (most), Guatemala (best), etc.). 2. S. E. Asia (upper Assam, China, Japan, Java, S. United States); cultivated.

Syn. Caff., Semen Coffea; Fr. Café; Ger. Kaffee (bohnen), Caffeia; Caffein, Theine, Guaranine, Trimethylxanthine, Methyltheobromine; Fr. Caféine, Théine; Ger. Coffeinum, Koffein, Kaffeïn, Thein.

Cof'fe-a. L. for coffee, after Coffee, a province of Narea, in Africa, where it grows abundantly; Arabic name of the decoction—*chaubé, cavé, cahua, caova.*

A-rab'i-ca. L. Arabian—*i. e.,* its chief habitat.

PLANT.—Handsome shrub or small tree 3–4.5 M. (10–15°) high, by cultivation trimmed down to 1.5–2 M. (5–6°); bark smooth, gray; leaves 10–15 Cm. (4–6′) long; 2.5–5 Cm. (1–2′) wide, ovate, alternate, coriaceous, glossy, entire; flowers small, fragrant, white, funnel-shape, cymes; fruit oval, 12 Mm. ($\frac{1}{2}$′) long, scarlet, but purple when ripe, 2-celled, 2-seeded drupe, each seed in a parchment-like endocarp; pericarp with scanty, scarcely succulent pulp, dehiscent; seed large, solitary in each cell, rounded back, flat on ventral surface (by which they face each other), hard, bony, grayish, deep narrow fissure in center.

ADULTERATIONS.—SEED: Inferior grades: natural discolored (yellow and brown grain); artificial colored (Prussian blue, indigo, sugar, egg-albumen)—removed by soaking in water; factitious coffee made of clay, kaolin, evaporated skimmed milk, etc.—sink in ether, have little taste and no groove on flat side. GROUND COFFEE: Sometimes roasted dandelion, chicory, amylaceous roots, corn, peas, beans, acorns, wheat, rye, sweet potatoes, coffee extract, etc.

CONSTITUENTS.—Caffeine (free and combined with caffeic acid) 1–2.3 p. c., caffearine, fat (olein, palmitin) 13 p. c., glucose, dextrin 15 p. c., proteins 13 p. c., caffeo-tannic acid, (chlorogenic, coffalic), volatile oil, citric acid, trigonelline, pectin, oxydase, moisture 12–15 p. c., ash 3–5 p. c., Mocha 7–8 p. c.—K, Na, Mg, carbonates, phosphates.

Caffeina. Caffeine.—While this is now prepared commercially—chiefly synthetically, or from tea and tea-dust (sweepings), it may be obtained from a strong infusion of tea or unroasted coffee by adding lead acetate to precipitate tannin, coloring matter, etc., filtering, removing excess of lead by hydrogen sulphide, concentrating, crystallizing. It is in white, flexible, silky, glistening needles, usually matted together in fleecy masses, odorless, bitter, efflorescent, soluble in water (46), hot water (5.5), alcohol (66), chloroform (5.5), ether (530), benzene (100), boiling benzene (22), acetone (50); saturated aqueous solution neutral; melts, when anhydrous, at 236° C. (457° F.). *Tests:* 1. Dissolve .01 Gm. in hydrochloric acid 1 cc., add potassium chlorate .1 Gm., evap-

orate to dryness, invert the container over a vessel containing a few drops of ammonia T. S.—residue purple, destroyed by fixed alkalies (murexide reaction). 2. Aqueous solution + tannic acid T. S.—precipitate, soluble in excess of reagent. 3. Dry to constant weight—loses 9 p. c.; incinerate—ash .05 p. c. 4. To .5 Gm. add sulphuric or nitric acid 5 cc.—colorless, faintly yellow (abs. of readily carbonizable substances). 5. Aqueous solution (1 in 50) + mercuric potassium iodide T. S.—no precipitate (abs. of alkaloids). *Impurities:* Alkaloids, readily carbonizable substances. Dose, gr. 1–5 (.06–.3 Gm.).

FIG. 392.—*Coffea arabica: A*, blooming and fruiting twig; *B*, fruit; *C*, fruit, cross-section; *D*, fruit, longitudinal section; *E*, seed still partly enclosed in the parchment-like endocarp.

Commercial.—Tree resembles our cherry, although more delicate, grows in clusters in hilly woods, 300–600 M. (1.000–2.000°) elevation; first known in Europe, 1652, as coming from Arabia, Abyssinia, where it was popular in the 15th century. The Dutch first grew it in Europe, 1690, and introduced it into America at Surinam, 1718, Cayenne, W. Indies, 1725. There are four varieties: 1, *Mocha,* best, smallest, dark yellow, growing on the Arabian hills around Mocha; 2, *Java* (*E. Indian, Ceylon*), largest, pale yellow; 3, *Rio, Brazilian* (*W. Indian, Demerara*), intermediate size, bluish or greenish-gray; 4, *Liberian* (*C. liberica*—most hardy and resistent to diseases), larger berries,

finer flavor. The seeds are separated from papery endocarp by drying, passing between wooden rollers, and through a winnowing mill. In roasting at 250° C. (482° F.), the fat, sugar, and tannin are destroyed, some caffeine volatilized, and an empyreumatic volatile oil (coffeol, coffeone), or some other active principle, volatile or otherwise, is developed—losing 8 p. c. water, 9 p. c. organic matter, becoming pulverizable, more aromatic, and more soluble in water. Much care should be exercised in this process to use closed vessels and not too great heat. Caffeine exists in all plants as a complex tannoid, and as such possesses decided but different physiological activity from the free base (alkaloid). Decaffeinated coffee results from incipient germination, or dissolving out nine-tenths of the caffeine from raw beans, then roasting.

PREPARATIONS.—1. *Caffeina Citrata.* Citrated Caffeine. (Syn., Caff. Cit.; Br. Caffeinæ Citras, Caffeine Citrate; Fr. Citrate de Caféine; Ger. Koffeincitrat.)

Manufacture: Dissolve citric acid 50 Gm. in hot distilled water 100 cc., add caffeine 50 Gm., evaporate to dryness on water-bath, constantly stirring toward the end, reduce to fine powder. It is a white powder, odorless, slightly bitter, acid taste and reaction; forms clear syrupy solution with small quantity of water, but caffeine precipitates on dilution, being redissolved by additional water; compound unstable; contains 48–52 p. c. of anhydrous caffeine, $C_8H_{10}O_2N_4$. *Tests:* 1. Mix 2 cc. of aqueous solution (1 in 10) with lime water (50)—clear in the cold, but turbid upon boiling. 2. Dry to constant weight—loses 5 p. c.; incinerate—ash .1 p. c. 3. Aqueous solution (1 in 100) 5 cc.+ mercuric sulphate T. S. 1 cc., heat to boiling, add potassium permanganate T. S. 1 cc.—white precipitate. 4. Heat .25 Gm. + sulphuric acid 5 cc. in dish on water-bath for 15 minutes, protected from dust—may be yellow, but not brown (abs. of tartrate). 5. Aqueous solution (1 in 100) 10 cc., acidulated with hydrochloric acid, + barium chloride T. S.—no turbidity (abs. of sulphate). *Impurities:* Heavy metals, tartrate, sulphate, water. Should be kept in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.).

2. *Caffeinæ Sodio-Benzoas.* Caffeine Sodio-Benzoate. (Syn., Caff. Sod.-Benz.; Fr. Soude benzoate de Caféine; Ger. Caffeinum-Natrium benzoicum, Koffein-Natriumbenzoat.)

Manufacture: Mix caffeine and sodium benzoate each 50 Gm., rub to smooth paste with alcohol q. s., dry in moderately warm place. It is a white powder, odorless, bitter, soluble in water (1.1), some caffeine separating on standing, alcohol (30), partly in chloroform; aqueous solution (1 in 20) neutral, slightly acid or alkaline, not reddened by phenolphthalein T. S.; contains 47–50 p. c. of anhydrous caffeine and 50–53 p. c. of sodium benzoate, $NaC_7O_2H_5$. *Tests:* 1. Heat—decomposes with evolution of white vapors of caffeine—carbonaceous residue effervesces with acids and colors flame yellow. 2. Aqueous solution + ferric chloride T. S.—salmon-colored precipitate; + diluted hydro-

chloric acid—white precipitate (benzoic acid). 3. Dry to constant weight—loses 5 p. c. *Impurities:* Heavy metals, water, chlorinated compounds, readily carbonizable substances. Dose, gr. 2–10 (.13–.6 Gm.), in powder, capsule, effervescent draught, hypodermically (?).

Prep.: 1. *Ampullæ Caffeinæ Sodio-Benzoatis, N.F.*, 8.5 gr. (.55 Gm.). Dose, 2–4 ampuls.

3. *Caffeinæ Sodio-Salicylas, N.F.*—caffeine, sodium salicylate, āā, 50 p. c., alcohol q. s. Dose, gr. 1–5 (.06–.3 Gm.).

4. *Pulvis Acetanilidi Compositus, N.F.*, 10 p. c.

5. *Sal Pot. Brom. Eff. Co., N.F.*, $\frac{4}{5}$ p. c.

Unoff. Prep.: Effervescent Citrated Caffeine, 1.9 p. c. of anhydrous caffeine, ʒj–2 (4–8 Gm.).

Properties.—Tonic, stimulant, nervine, antiemetic, laxative, diuretic, antiperiodic, antiseptic. Caffeine in small doses stimulates appetite, digestion, secretion of bile, quickens heart action, respiration, increases arterial tension, urine; normal doses, cerebral stimulant, causing nervous restlessness, wakefulness, increased mental activity; large doses (gr. 5–10; .3–.6 Gm.) produce heaviness of head, insomnia, delirium, rapid, feeble pulse, cold extremities, elevated temperature, convulsions, paralyzes cardiac muscle, but death occurs from paralysis of respiration; valuable as a hydragogue diuretic; ordinary salts not suitable for hypodermic use as they decompose by the presence of water. Caffeine sodio-benzoate as a diuretic, cerebral and cardiac stimulant has the advantage of being moderately stable and non-irritating.

Uses.—Caffeine in neuralgia or nervous headaches, diarrhea of cholera, phthisis, cardiac and renal dropsies, lithemia, gout, insomnia of chronic alcoholism, adynamic fevers. Coffee in intermittents, asthma paroxysms, opium narcosis, to antagonize general torpor of nervous centers; it is used mostly as a beverage, for which alone about 1,500,000,000 pounds (680,272 Kg.) are consumed annually, making 1 pound (.46 Kg.) to every living person; in the United States about 6–7 pounds (2.7–3 Kg.) per capita; in Holland 10 pounds (4.6 Kg.); an average cup contains 2.61 gr. (.2 Gm.) of caffeine.

Derivative Products:

1. *Coffea arabica* or *C. liber'ica; Coffea Tosta, Coffee, Roasted Coffee, N.F.*—The dried ripe seed, deprived of most of the seed-coat, and roasted until a dark brown color and characteristic aroma are developed yielding not less than 1 p. c. of caffeine, 3–5 p. c. of ash, and 10 p. c. of fat. Seed oval, variable size, one side convex, other flat with longitudinal groove showing papery seed-coat traces in cleft; characteristic aroma, pleasantly bitter taste. Powder, deep brown—many seed-coat fragments of parenchyma and stone cells, many endosperm cells with porous walls, oil and aleurone grains; starch grains few or wanting, no tracheæ. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Coffeæ* (1st menstruum: glycerin 6.5 cc., alcohol 25, water 68.5; 2d: 25 p. c. alcohol q. s. 100), dose, ʒss–1 (2–4 cc.). Decoction, Infusion.

RUBIACEÆ

2. *C. mauritia'na, Mauritus,* and *C. zanguebar'ia,* Zanzibar, Mozambique, furnish acceptable coffee, but only the *C. liber'ica* approaches, in importance and flavor, the long universally recognized *C. arabica.*

Substitute Products:

1. *Co'la ni'tida (acumina'ta), Cola Nut.*—Sterculiaceæ, W. Africa (page 407); seed contain caffeine 2 p. c., theobromine, tannin, volatile oil.

2. *Paullin'ia Cupa'na, Guarana.*—Sapindaceæ. Brazil (see page 389); seed contain caffeine (guaranine) 4–5 p. c., tannin 2.6 p. c., starch, mucilage, fat, saponin, resin, volatile oil.

IPECACUANHA. IPECAC, *U.S.P.*

Cephaëlis { **Ipecacuanha,** (*Brotero*) *A. Richard,* **acuminata,** *Karsten.* } The dried rhizome and roots with not more than 5 p. c. over ground stems or 2 p. c. other foreign organic matter, yielding not less than 1.75 p. c. ether-soluble alkaloids.

Habitat. Brazil to Bolivia, Columbia, damp forests; cultivated in India.

Syn. Hippo, Poaya; Br. Ipecacuanhæ Radix; Fr. Ipécacuanha annelé (officinale), Racine brésilienne; Ger. Brechwurzel, Ruhrwurzel.

Ceph-a-ë'lis. L. fr. Gr. κεφαλή, a head, + ἕιλω, to collect—*i. e.*, flowers collected into a capitulum.

Ip-e-cac-u-an'ha. L. fr. Braz. Indian name *ipecaaguen,* which means "smaller roadside sickmaking plant."

A-cu-mi-na'ta. L. *acuminatus,* pointed, acute—*i. e.*, apex of the leaves.

Ip'e-cac. An abbreviation of ipecacuanha.

Plants.—Shrubby perennials; stem .3–.5 M. (12–18′) high, with often .3 M. (12′) additional underground, decumbent or erect, woody, knotted with leaf-scars, smooth and gray at the base, quadrangular, pubescent and green above, simple or branched; leaves few, 6–8, somewhat crowded at the top, 7.5–10 Cm. (3–4′) long, 2.5–5 Cm. (1–2′) broad, stipulate, opposite, petiolate, obovate, entire, wavy margins, dark green, smooth above, paler, pubescent, prominent veined beneath; flowers Jan.–Feb., small white dense heads, 8–20 together, funnel-shape, hairy; fruit May, in clusters of dark purple berries 12 Mm. ($\frac{1}{2}$′) long, each with 2 small, plano-convex, stony seed. Roots (*C. Ipecacuanha*): *Rio,* in cylindrical, curved, sharply flexuous, pieces, occasionally branched, 3–15 Cm. ($1\frac{1}{5}$–6′) long, 1–4 Mm. ($\frac{1}{25}$–$\frac{1}{6}$′) thick, grayish-black, smooth or closely annulate, with thickened, incomplete rings, usually transverse fissures with vertical sides; bark (smooth) thin, one-ninth diameter of root, or (annulated) two-thirds its diameter; fracture short, easily separable from tough, fibrous wood; odor distinctive, dust sternutatory; taste bitter, nauseous, acrid; rhizome cylindrical, 10 Cm. (4′) long, 2 Mm. ($\frac{1}{12}$′) thick, wrinkled, few elliptical scars, distinct pith, one-sixth the entire diameter: (*C. acuminata: Carthagena, Panama,* 4–6.5 Mm. ($\frac{1}{6}$–$\frac{1}{4}$′) thick, grayish-black, annulations less numerous, single starch grains larger in the medullary rays of wood. Powder, light brown—cork cells, starch grains up to

.015 Mm. ($\frac{1}{1700}$'—Rio)–.020 Mm. ($\frac{1}{1250}$'—Carthagena) in diameter, raphides of calcium oxalate, porous tracheids. *Solvents:* alcohol; water (injured by boiling). Dose, emetic, gr. 20 (1.3 Gm.), or gr. 5–10 (.3–.6 Gm.), repeated in 10-minute intervals, each followed by hot chamomile tea; nauseant, diaphoretic, expectorant, gr. 1–2 (.06–.13 Gm.).

ADULTERATIONS.—ROOT: Roots of allied species—striated, undulated (most important), *Cephaëlis tomento'sa*, excessive portion of non-annulate woody stem; roots of *Trios'teum perfolia'tum* and *Heter-*

FIG. 393.—*Cephaëlis Ipecacuanha.*

FIG. 394.—Ipecac root; normal size.

op'teris pauciflo'ra, both resembling somewhat the official, the latter containing an inulin-like body instead of starch; Johore and Matto Grosso ipecac—larger, but annulations not so deep as the official. POWDER: Starches, flour, almond-meal, etc., all being recognized easily under the microscope—the first two by the shape of granules, the last by scurvy testa, oil-cells, and yielding hydrocyanic acid when infused with water; ground olive stones 3–40 p. c.

Commercial.—Sound ipecac in quality is proportionate to the thick-

ness of the bark (75–90 p. c.), and the thinness of the wood (10–25 p. c.), as most of the alkaloids reside in the former; that with very thick bark is designated as "bold" (fancy), that with thick woody center as "wiry;" the stem portion should not indicate having been leaf-bearing, as such parts exposed to light and air are always weaker in alkaloids. Ipecac was known first in Europe, 1762, as about this time Helvetius, a Dutch physician, became celebrated in Paris from its secret use; it was, however, in 1688, purchased from him by Louis XIV. for 1,000 louis d'or ($4,600). It grows in rich loam of hot, moist forests, under trees in bunches, presenting two varieties according to its woody or herbaceous stems, the latter usually prostrate and covered with vegetable débris, otherwise exactly alike. This growth-habit produces a great distinction between the upper and lower stem-portions, causing the latter to be collected often with the root, when the product is termed "stemmy." The color of the roots of either kind is not uniform, both furnishing *brown*, *red*, and *gray*, which difference is only superficial, depending solely upon season of year collected, age, soil, climate, and mode of curing; the brown is least bitter and most abundant with us; the gray is most bitter and the larger. The root is collected at any time when the ground is soft (mainly Jan.–March), except in rainy weather, as then cannot dry properly, by *poayeros* (collectors, fr. *poaya*, Braz. name of the plant), who catch the stem, pull it backward as far as possible, and thrust deep into the ground a stick with broad, sharp end, thus cutting the ramifications, but leaving sufficient roots to produce, from adventitious buds, new plants the following year. The plant-juice is so irritating as to produce sores upon the hands and elsewhere, consequently collectors only accept such labor in the absence of rubber-gathering, and that otherwise more congenial, thus accounting largely for the drug's high price. Roots are freed from adhering earth by shaking, put into bags, at night assorted, next day spread in the sun and carefully dried 3–4 days, being protected at night from heavy dews, then broken into small pieces, separated from any remaining earthy particles by sieves, and packed tightly in bags or hide-bound bales (seroons), which are stored carelessly awaiting sale—a condition, along with the incident exposure to damp weather and river-water in shipment, that renders three-fourths of the output considerably damaged by moldiness. There are two varieties: 1, *Rio, Brazilian, Para* (*C. Ipecacuanha*), distributed widely through Brazil, Bolivia, being collected chiefly in proximity to the Itenez River, and exported via Rio Janeiro or Para; 2, *Carthagena, Columbian* (*C. acuminata*), grown wild mostly in Columbia, being exported chiefly via Carthagena; contains an equal amount of total alkaloids, but more cephaëline and less emetine than Rio.

Constituents.—Alkaloids 2.28–3.36 p. c.: Emetine 2–3.14 p. c., Cephaëline .6 p. c., psychotrine, ipecacuanhic acid (ipecacuanhin) 2.25 p. c., Emetoidine (kryptonine), $C_{29}H_{40}O_9N_2$ (colloidal), ipecamine, hydroipecamine, o-methylpsychotrine, emetamine, choline, resin,

starch 40 p. c., wax, fat, volatile oil, erythrocephaëlin (coloring matter —deep purple with alkalies), sucrose, ash 1.8–4.5 p. c.

Emetine (Methyl-cephaëline), $C_{29}H_{40}O_4N_2$.—Obtained by adding basic lead acetate to alcoholic tincture, filtering, removing excess of lead with diluted sulphuric acid, neutralizing filtrate, distilling off alcohol, shaking out clear residual liquid with ether and ammonia, shaking out ether solution with weak sulphuric acid, and shaking repeatedly this acidulated solution with sodium hydroxide, in the presence of ether, until cephaëline (base soluble in caustic alkali) is separated completely; emetine (base insoluble in caustic alkali) is converted into hydrochloride, recrystallized from water, and finally precipitated with ammonia. It is amorphous, white, becoming yellow by exposure, soluble in alcohol, ether, benzene, chloroform; forms salts, most of which are crystalline. Dose, expectorant, gr. $\frac{1}{200}$–$\frac{1}{60}$ (.0003–.001 Gm.); emetic, gr. $\frac{1}{16}$–$\frac{1}{4}$ (.004–.016 Gm.). Poisonous in large quantities; impure emetine is 10 times weaker.

Emetinæ Hydrochloridum, Emetine Hydrochloride, $C_{30}H_{44}O_4N_2.2HCl$, *U.S.P.*—(Syn., Emet. Hydrochl.; Fr. Chlorhydrate de Emetine; Ger. Emetinhydrochlorid, Salzsaures Emetin.) This hydrochloride of the alkaloid from ipecac, or prepared synthetically, is obtained by dissolving emetine in diluted hydrochloric acid, allowing to crystallize. It is a white, very slightly yellowish, crystalline, odorless powder, darker on exposure to light, soluble in water, alcohol; aqueous solution (1 in 20) slightly acid; contains variable amounts of water of crystallization. *Tests:* 1. Aqueous solution (1 in 100), + iodine T. S., mercuric potassium iodide T. S., or platinic chloride T. S.—precipitates. 2. With sulphuric acid containing in each cc. about .005 Gm. of molybdic acid—bright green. 3. Aqueous solution (1 in 2) + silver nitrate T. S.—white precipitate, insoluble in nitric acid; dry at constant weight—loses 19 p. c.; incinerate—ash negligible. *Impurities:* Cephaëline, water, readily carbonizable substances. Should be kept dark, in dark amber-colored vials. Dose, expectorant, gr. $\frac{1}{12}$–$\frac{1}{6}$ (.005–.01 Gm.); emetic, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.).

Cephaëline, $C_{28}H_{38}O_4N_2$.—This is 2–5 times stronger than emetine, the two representing the drug's activity, and relative proportion varying; it is crystalline, white, becoming yellow by exposure, distinguished from emetine by its solubility in caustic alkalies and by being less soluble in ether; forms uncrystallizable salts. Dose, same as emetine.

Psychotrine, $C_{28}H_{36}O_4N_2$.—This exists in ipecacuanha in small amount compared with the two preceding alkaloids, and unlike them is only slightly soluble in ether; obtained by extracting with chloroform the ammoniacal liquid, from which emetine and cephaëline have been separated by ether; occurs in crystals which separate from ether in lemon-yellow transparent prisms, melts at 138° C. (281° F.), soluble in alcohol, chloroform.

Ipecacuanhic Acid (Cephaëlic Acid), $C_{14}H_{18}O_7$.—An amorphous, bitter glucoside, once believed identical with gallic acid, but more

closely resembles caffeo-tannic acid; obtained by precipitating decoction with lead acetate, dissolving precipitate in acetic acid, then precipitating with lead subacetate; it is bitter, amorphous, brown, soluble in alcohol, green with ferric salts.

PREPARATIONS.—1. *Fluidextractum Ipecacuanhæ.* Fluidextract of Ipecac. (Syn., Fldext. Ipecac., Fluid Extract of Ipecac; Br. Extractum Ipecacuanhæ Liquidum; Fr. Extrait fluide d'Ipécacuanha; Ger. Ipecacuanhafluidextrakt.)

Manufacture: Similar to Fluidextractum Ergotæ, page 63; 1st menstruum: alcohol 30 cc., water 30, diluted hydrochloric acid 15; 2d menstruum: 40 p. c. alcohol; reserve first 80 cc., in which dissolve soft extract, assay, and add enough 2d menstruum for the 100 cc. to contain 1.35–1.65—1.5 Gm. of ether-soluble alkaloids. Dose, ♏j–20 (.06–1.3 cc.).

Prep.: 1. *Syrupus Ipecacuanhæ.* Syrup of Ipecac. (Syn., Syr. Ipecac.; Fr. Sirop d'Ipécacuanha; Ger. Brechwurzelsirup, Ipecacuanhasirup.)

Manufacture: 7 p. c. Mix thoroughly fluidextract of ipecac 7 cc., glycerin 10. syrup q. s. 100 cc. Dose, expectorant, ♏v–15 (.3–1 cc.); emetic, ℥ss–4 (2–15 cc.). 2. *Tinctura Ipecacuanhæ, N.F.,* 10 p. c., alcohol 20 cc., aq. dest. 60, then latter q. s. 100 cc. Dose, ♏xv–30 (1–2 cc.); substitute for the once official wine; 3. *Tinctura Ipecacuanhæ et Opii,* Tincture of Dover's Powder, *N.F.,* 10 p. c., + tincture of opium 100 cc. evaporated to 58, diluted alcohol q. s. 100 cc. Dose, ♏v–20 (.3–1.3 cc.).

Prep.: 1. *Syrupus Ipecacuanhæ et Opii, N.F.,* 8.5 p. c.—tr. ipecac. et opii 8.5 cc., spirit of cinnamon $\frac{2}{5}$ cc., cinnamon water 3.2, syrup q. s. 100 cc. Dose, ℥ss–2 (2–8 cc.).

4. *Mistura Rhei Composita, N.F.,* $\frac{3}{10}$ p. c. 5. *Syrupus Asari Compositus, N.F.,* $\frac{3}{10}$ p. c.

2. *Pulvis Ipecacuanhæ et Opii.* Powder of Ipecac and Opium. (Syn., Pulv. Ipecac. et Opii., Compound Powder of Ipecac, Dover's Powder; Br. Pulvis Ipecacuanhæ Compositus; Fr. Poudre d'Ipécacuanha opiacée—de Dover; Ger. Pulvis Ipecacuanhæ opiatus, Doversches Pulver, Pulvis Doveri.)

Manufacture: 10 p. c. Triturate together thoroughly, ipecac 10 Gm., powdered opium 10, lactose 80, until the mixture is reduced to a very fine uniform powder. It is grayish-white, light brown; microscopically —angular, cone-shaped fragments, slowly soluble in water or chloral hydrate T. S., strongly polarizing light with display of colors (fragments of lactose), tissues of ipecac and the capsules of opium poppy. Dose, gr. 5–10 (.3–.6 Gm.).

3. *Pilulæ Laxativæ Compositæ, N.F.,* $\frac{1}{16}$ gr. (.004 Gm.). 4. *Ampullæ Emetinæ Hydrochloridi, N.F.,* $\frac{1}{2}$ gr.

Unoff. Preps.: Decoction, Infusion, each, 5 p. c., ℥ss–1 (15–30 cc.). *Extract,* gr. $\frac{1}{20}$–$\frac{1}{2}$ (.003–.03 Gm.). *Pilula Ipecacuanhæ cum Scilla* (Br.)—ipecac 6, opium 6, potassium sulphate 48, squill 20, ammonia-

cum 20, syrup of glucose q. s. for mass, gr. 4–8 (.26–.5 Gm.). *Wine*, 10 p. c., ♏j–60 (.06–4 cc.). *Trochiscus* (Br.), each, $\frac{1}{3}$ gr. (.02 Gm.).

PROPERTIES.—Emetic, nauseant, expectorant, diaphoretic, sternutatory (cholagogue, antiseptic, hemostatic, counter-irritant). Small doses (gr. $\frac{1}{8}$–$\frac{1}{4}$; .008–.016 Gm.), stomachic, tonic, large doses (gr. 5–20; .3–1.3 Gm.), emetic in 30 minutes, not violent nor depressing; if doses repeated, have tolerance, catharsis; may cause irritation, hemorrhage. Emetine kills animals by cardiac paralysis. Vomiting due to local irritation of the stomach and a direct action upon vomiting center in the medulla; it increases, by stimulation, the secretion of bile, bronchial and intestinal mucus.

USES.—Acute indigestion, nauseating bilious headache, small doses for bronchitis, whooping-cough, asthmatic catarrh, spasmodic croup (here syrup given until vomiting occurs), spasmodic asthma, pneu-

FIG. 395.—Undulated ipecacuanha.

FIG. 396.—Striated ipecacuanha.

monia, rigidity of os uteri, hemoptysis, hemorrhage, atonic dyspepsia, vomiting in pregnancy (hourly ♏j; .06 cc. of tincture), catarrhal jaundice (gr. 20; 1.3 Gm. daily), pyorrhea (fldext., alcresta), chronic dysentery, diarrhea, hectic sweats, cholera, cholera morbus, remittent fever, urticaria, cases of poisoning; locally in ophthalmia (decoction). As diaphoretic and expectorant give at long intervals; the syrup always to infants. Its action is somewhat irregular, gr. 5 (.3 Gm.) sometimes being as effective as gr. 15 (1 Gm.). Emetine gr. $\frac{1}{10}$ (.006 Gm.) has induced vomiting, while gr. 12 (.8 Gm.) given in 24 hours have caused no unpleasant symptoms.

Poisoning: Usually have severe vomiting of stomach contents, mucus, blood, etc. Unless thoroughly vomited, wash out stomach with tannin solution, if necessary follow with opium, belladonna, cardiac stimulants.

Incompatibles: Lead and mercury salts, vegetable acids, astringent infusions, bismuth compounds, phenol and hydrocyanic acid.

Synergists: Emetics, sedative expectorants, warm drinks.

Substitute Products:

1. *Psycho'tria emet'ica, Striated Ipecac.*—Root 6 Mm. (¼′) thick, longitudinally wrinkled, not annulate, transverse fissures through bark, purplish-brown, bark thick; contains little emetine, much sugar, no starch. There is a small striated ipecac (a species of *Richar'd(so'n)ia*) 3 Mm. (⅛′) thick, otherwise same as the ordinary striated.

2. *Richar'd(so'n)ia sca'bra, Undulated (Farinaceous) Ipecac.*—Undulate wrinkled; annulate, transversely fissured, brownish-gray; bark white, mealy, not bitter, wood nearly as thick as the bark.

3. *Calceola'ria (Ionid'ium) Ipecacuanha, White Ipecac.*—Violaceæ. Branched, not annulate, longitudinally wrinkled, whitish-yellow; wood porous, thick, yellowish, no starch.

4. *Ascle'pias curassav'ica, Bastard Ipecac.*—C. and S. America; has short rootstock abruptly divided into many yellowish rootlets.

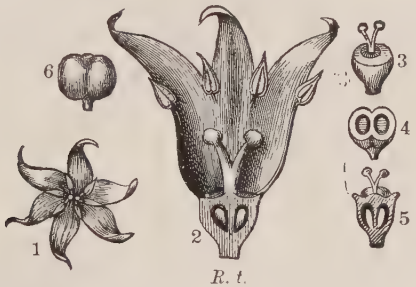
Allied Plants:

1. *Mitchel'la re'pens, Mitchella, Squaw Vine, Partridge-berry, N.F.*—The dried plant with not more than 5 p. c. of foreign organic matter; N. America. Creeping evergreen of the woods, reaching .3–.6 M. (1–2°) in length. Occurs in loosely matted masses of—branches, rhizomes, fine roots, stems and leaves; rhizomes brownish, filiform, roots fibrous; stems quadrangular; light green, striated; leaves opposite, dark green, smooth, coriaceous, ovate, entire, up to 2 Cm. (⅘′) long, short petiole, lower surface shiny; flowers purplish, fragrant; fruit scarlet-red berry; odor faint; taste slightly bitter. Powder, grayish-green -numerous calcium oxalate raphides, epidermal cells, stomata, chlorenchyma cells, some with amorphous content, tracheæ, parenchyma, starch grains; solvent: diluted alcohol; contains saponin-like substance, resin, wax, gum, sugar. Tonic, astringent, diuretic; resembles chimaphila and viburnum, all at times being prescribed together. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Mitchellæ* (diluted alcohol): Preps.: 1. *Elixir Aletridis Compositum,* 6.55 p. c.; 2. *Elixir Heloniadis Compositum,* 12.5 p. c.

2. *Ru'bia tincto'rum, Madder.*—The root, U.S.P. 1820–1870; S. Europe, Asia. Perennial herb, square stem, covered with short prickles by which it climbs; leaves elliptical, 7.5 Cm. (3′) long; flowers yellow; root creeping, 5 Mm. (⅕′) thick, reddish, sweetish, bitter, acrid, astringent taste; contains rubian (yellow), alizarin (orange-red), ruberythrin (yellow needles, blood-red with alkalies), purpurin. Used as tonic, diuretic, emmenagogue; dropsy, amenorrhea, rachitis, dyeing. Dose, gr. 15–60 (1–4 Gm.).

3. *Sambu'cus canaden'sis* or *S. ni'gra, Sambucus, Elder Flowers, N.F.*—Caprifoliaceæ. The air-dried flower with not more than 2 p. c. of foreign organic matter; N. America (damp places). Semi-shrubby perennial, slightly woody, 1.5–3 M. (5–10°) high; stem branching,

covered with rough, pitted-gray bark, central pith large, branches smooth; fruit, ovoid drupe, 6 Mm. ($\frac{1}{4}'$) long, red then purplish-black. Flowers, small 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}'$) broad, shriveled; corolla cream-colored, brownish-yellow, rotate, campanulate, 5-lobed; stamens 5, anthers yellow, pollen with punctate markings; odor faintly sweet,



R. t.

Fig. 397.—*Rubia tinctorum: 1*, open flower; *2*, longitudinal section of flower enlarged; *3*, ovary; *4*, cross-section of ovary; *5*, longitudinal section of ovary; *6*, fruit.

aromatic; taste slightly bitter. Powder, brownish-yellow—soon becomes worm eaten unless a preservative (sodium chloride) is added; contains volatile oil .3–.5 p. c., resin, fat, wax, mucilage, tannin. Stimulant, carminative, diaphoretic, sudorific, diuretic, alterative, flavoring; used mostly externally in fomentation, poultice, and ointment; rheumatism, erysipelas, abscesses, etc.; the water for cooling application to the eyes. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Stillingiæ Compositum*, 12.5 p. c. 2. *Species Laxativæ*, 25 p. c. *S. ni'gra.*—Europe; tree, 4.5–6 M. (15–20°) high, 10–15 Cm. (4–6′) thick, compound cymes smaller than the preceding. *S. Eb'ulus, Dwarf Elder.* All parts with strong, disagreeable odor, bitterish, acrid taste, the 4-seeded fruit, resembling elderberries; laxative; *S. maderen'sis*, Madeira; less aromatic than *S. nigra.*

Fig. 398.—*Sambucus canadensis.*

4. *Vibur'num prunifo'lium, Viburnum, Black Haw, N.F.*—The dried root-bark, with not more than 7 p. c. of wood or other foreign organic matter, yielding not more than 3 p. c. of acid-insoluble ash: United States, New York to Florida. Handsome shrub, 3–6 M. (10–20°) high; leaves 2.5–5 Cm. (1–2′) long, 12–16 Mm. ($\frac{1}{2}$–$\frac{2}{3}'$) broad, serrate; flowers white cymes; fruit oval, black drupe (berry), sweet, edible. Bark, in irregular, transversely curved, quilled pieces, 1.5–6 Cm. ($\frac{3}{5}$–$2\frac{2}{5}'$) long, .5–1.5 Mm. ($\frac{1}{50}$–$\frac{1}{16}'$) thick, grayish-brown, or, where outer cork has scaled off, brownish-red; wrinkled, inner surface reddish-

brown, striate; fracture short, uneven; odor strong, sourish; taste distinctly bitter, somewhat astringent. Powder, dark brown—many stone cells, calcium oxalate rosette aggregates, prisms, lignified cork tissue, parenchyma cells, starch grains, few bast-fibers; solvent: 67 p. c. alcohol; contains viburnin, valeric acid, resin (brown, bitter) 2.5 p. c., tannin, sugar, salts, ash 8–9 p. c. Diuretic, tonic, antispasmodic, nervine, astringent; in threatened abortion, nervous diseases of pregnancy, dysmenorrhea, menorrhagia, after-pains, asthma, hysteria. Dose, ʒss–2 (2–8 Gm.); 1. *Fluidextractum Viburni Prunifolii* (67 p. c. alcohol): Prep.: 1. *Elixir Viburni Prunifolii*, 12.5 p. c., dose, ʒj–2 (4–8 cc.). Extract, gr. 3–10 (.2–.6 Gm.). Decoction, 5 p. c., Infusion, 5 p. c., each, ʒj–2 (30–60 cc.).

a *b*

Fig. 399.—*Viburnum prunifolium*, *a*, trunk bark, *b*, root bark.

5. *Viburnum Op'ulus*, var. *america'num*, *High Bush*, *Cranberry Bark*, *Cramp Bark*, *N.F.*—The dried bark of the stem with not more than 5 p. c. of adhering wood or other foreign organic matter; United States, low grounds, north and west. Handsome perennial shrub, 1.3–3.5 M. (4–12°) high; stem smooth, branched; leaves 3-lobed, dentate; flowers cymes, large, greenish-white; fruit 12 Mm. ($\frac{1}{2}'$) long, ovoid, red (substitute for cranberries). Bark, in strips, 20–30 Cm. (8–12′) long, 12–18 Mm. ($\frac{1}{2}$–$\frac{3}{4}'$) broad, .5–3 Mm. ($\frac{1}{50}$–$\frac{1}{8}'$) thick, quills, chip-like fragments, light gray, brownish stripes and lenticels, fissured or thinly scaly, inner surface yellowish-brown, short oblique striæ; fracture in 2 layers, short weak, whitish to brownish; odor slight, characteristic; taste mildly astringent, bitter. Powder, light grayish-

brown—cork cells, calcium oxalate rosettes, starch grains, parenchyma with amorphous substance, occasional tracheal fragments with wood-fibers, bast-fibers and stone cells; solvent: 67 p. c. alcohol; contains viburnin, valeric acid, resin 8 p. c., tannin, salts, ash 8–9 p. c. Diuretic, tonic, antispasmodic, nervine, astringent, weaker than *V. prunifolium;* nervous conditions of pregnancy, abortive preventive, dysmenorrhea, menorrhagia, ovarian irritation, asthma, hysteria. Dose, ʒss–2 (2–8 Gm.); 1. *Fluidextractum Viburni Opuli*, dose, ʒss–2 (2–8 cc.): Preps.: 1. *Elixir Viburni Opuli Compositum*, 7.5 p. c., + fldext. of trillium 15, fldext. of aletris 7.5, dose, ʒj–2 (4–8 cc.); 2. *Elixir Aletridis Compositum*, 3.275 p. c.; 3. *Elixir Heloniadis Compositum*, 3.2 p. c. 2. *Tinctura Viburni Opuli Composita*, 3.5 p. c., + dioscorea 3.5, scutellaria 1, clove 5, cinnamon 6.5; menstruum: glycerin 7.5 cc., alcohol 75, water 17.5, finishing with 75 p. c. alcohol q. s. 100, dose, ʒj–2 (4–8 cc.)—substitute for Hayden's Viburnum Compound. Decoction, Infusion, each, 5 p. c., ʒj–2 (30–60 cc.). *V. obova'tum, Small Viburnum, Black Haw;* S. United States; shrub 2.4 M. (8°) high, fruit black, leaves broadly obovate, leathery, bitter, also used as antiperiodic.

Fig. 400.—*Viburnum Opulus.*

6. *Trios'teum perfolia'tum, Fever Root, Fever-wort, Horse-gentian.*—The root (rhizome), U.S.P. 1820–1870; United States. Perennial herb 1–1.3 M. (3–4°) high, hirsute; leaves pubescent beneath, 15 Cm. (6′) long; flowers purplish, fruit dry yellow drupe, 12 Mm. (½′) long. Root 15–20 Cm. (6–8′) long, 15 Mm. (⅗′) thick, knotty, brownish-yellow, bitter, nauseous; contains bitter principle, starch. Used as cathartic, emetic, diuretic, substitute for ipecac; in decoction, extract, infusion. Popular with Indians for fevers, amenorrhea. Dose, gr. 15–30 (1–2 Gm.).

64. VALERIANACEÆ. Valerian Family.

Va-le-ri-a-na′se-e. L. *Valerian-a* + aceæ, fr. *Valerianus* or *Valerius*, who first used it in medicine—*valere*, to be strong, healthful—*i. e.*, its odor and medicinal virtues. Herbs. Distinguished by possessing a strong-scented volatile oil; leaves opposite, exstipulate; calyx superior, tube adnate to ovary; corolla mostly 5-lobed, tubular, epigynous; stamens 1–4, inserted on corolla-tube; ovary, 1 fertile cell, 2 abortive or empty; fruit dry, often pappose; temperate climates; stimulant, antispasmodic, tonic, (vol. oil).

Genus: **1. Valeriana.**

VALERIANA. VALERIAN, *U.S.P.*

Valeriana officinalis, *Linné.* { The dried rhizome and roots, with not more than 5 p. c. foreign organic matter, yielding not more than 10 p. c. acid-insoluble ash.

Habitat. Europe, N. Asia, in moist as well as dry localities, banks of streams; naturalized in New England and New York; cultivated.

Syn. Valer., Wild, Great Wild, English, German, Common, Cat's ,Vermont or American-English Valerian, Setwall, Vandal Root, All Heal, Radix Valerianæ Minoris; Br. Valerianæ Rhizoma; Fr. Valériane officinale, Racine de Valériane; Ger. Radix Valerianæ, Baldrian, (Wilde) Baldrianwurzel.

Va-le-ri-a′na. L. see etymology, above, of Valerianaceæ.

Of-fi-ci-na′-lis. L. see etymology of (*Smilax*) *officinalis*, page 122.

FIG. 401.—*Valeriana officinalis.*

PLANT.—Large perennial herb; stem .6–1.3 M. (2–4°) high, branched at top, cylindrical, hollow, fluted and channeled, often hairy; leaves imparipinnate with long clasping petioles; leaflets 4–10 pairs, 2.5–6.5 Cm. (1–2½′) long, lanceolate, dentate; flowers small, white or rose color, agreeably odorous, terminal corymbs, corolla 5-lobed, stamens 3, sessile; fruit, capsule, 4 Mm. (⅙′) long, plano-convex, compressed,

4-ribbed, pale brown, 1-seeded, oblong-ovate. RHIZOME, upright, 2–4 Cm. ($\frac{4}{5}$–$1\frac{3}{5}'$) long, 1–2 Cm. ($\frac{2}{5}$–$\frac{4}{5}'$) thick, usually cut longitudinally into 2–4 pieces, yellowish-brown, upper portion with stem-bases, frequently, with a short, horizontal branch or stolon, from outer surface numerous, slender, brittle roots; fracture short, horny; internally light brown with a thick bark and narrow, central cylinder; odor of valeric acid, stronger upon aging; taste sweetish, camphoraceous, somewhat bitter. POWDER, grayish-brown—numerous starch grains, .003–.02 Mm. ($\frac{1}{8325}$–$\frac{1}{1250}'$) broad, tracheal fragments, walls with pores or thickenings, narrow fibers with walls thin, porous, lignified, occasional fragments of epidermis with root hairs and fragments of cork. *Solvents:* water; alcohol. Dose, gr. 15–60 (1–4 Gm.).

ADULTERATIONS.—Rhizome and roots of *V. Phu, V. dioi'ca, Cynan'chum Vincetox'icum, Veratrum album, Si'um latifo'lium, Scabio'sa succi'sa,* and *S. arven'sis,* also several ranunculaceous roots.

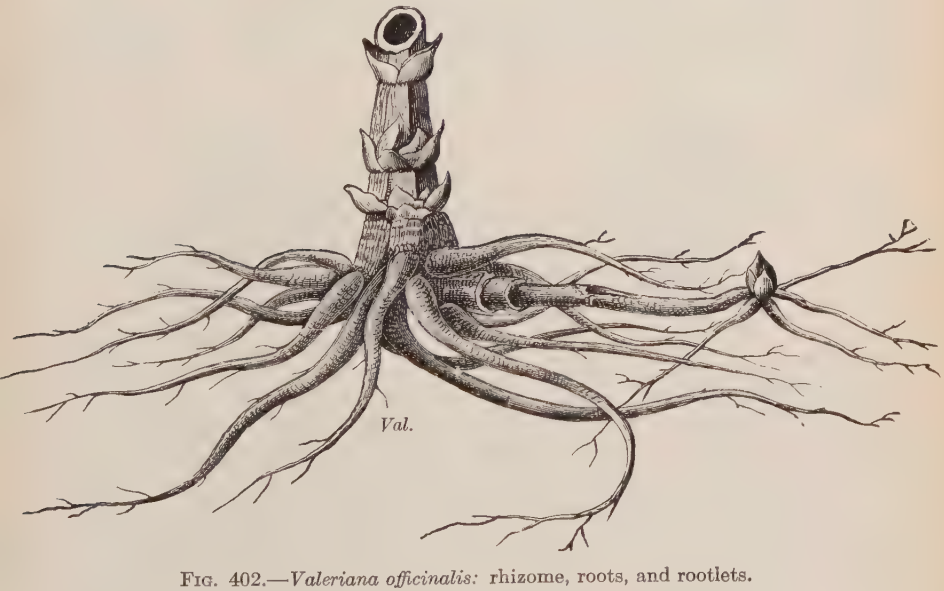


FIG. 402.—*Valeriana officinalis:* rhizome, roots, and rootlets.

Commercial.—Valerian flourishes equally well in damp woods, meadows, and dry places, affording a variability in characteristics that has suggested four varieties, all, however, being one and the same and yielding identical constituents; it is cultivated in England (best), Germany, Holland, United States (New Hampshire, Vermont, New York), very little of the wild grown, although stronger and smaller, being utilized. Rhizome is collected in the spring before stem begins to shoot, or preferably in autumn, when leaves decay, from dry soil plants, and at first is without specific odor; tops are cut off in the spring to prevent seeding and thereby strengthen the rhizome, which must

be dug carefully, washed, dried (entire or split) in kilns, packed tightly, and kept dry to prevent deterioration.

CONSTITUENTS.—Volatile oil .5–3 p. c., Valeric acid, formic, acetic, malic acids, chatinine, tannin, resin, starch, mucilage, sugar, ash 15–20 p. c. (largely manganese).

Volatile Oil, (Oleum Valerianæ), U.S.P. 1860–1890.—This is obtained by distilling with water; it is a pale green liquid, pungent valerian odor, aromatic taste, sp. gr. 0.945, yellow and viscid on exposure, levorotatory; contains: 1, a terpene—borneene, $C_{10}H_{16}$, boiling at 157° C. (315° F.); 2, an alcohol—borneol (liquid, and solid crystalline compound), $C_{10}H_{18}O$, with the liquid portion chromic acid yields camphor along with formic, acetic, and valeric acids, these latter being likewise present in old rhizomes from slow oxidation of this $C_{10}H_{18}O$; 3, an ether—borneol, or borneol oxide, $(C_{10}H_{17})_2O$, greenish syrupy oil, but colorless when rectified, along with formic, acetic, and valeric esters, which, by oxidation, form their respective acids. Recent investigators claim these components to be pinene, camphene, borneol, and the formic, acetic, and isovaleric esters of borneol. Dose, ♏j–5 (.06–.3 cc.).

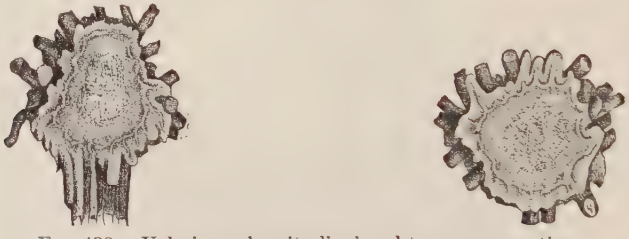


FIG. 403.—Valeriana: longitudinal and transverse sections.

Valeric (Valerianic) Acid, Acidum Valer(ian)icum, $C_5H_{10}O_2$, U.S.P. 1860 1870.—Not in fresh rhizome, but results from oxidation of the volatile oil on exposure—a change believed dependent largely upon presence of manganese; however, this is obtained mostly by oxidizing amyl alcohol with sulphuric acid and potassium dichromate. It is an oily liquid, volatile, with characteristic odor, salts sweet-tasted.

PREPARATIONS.—1. *Tinctura Valerianæ.* Tincture of Valerian. (Syn., Tr. Valer.; Fr. Teinture de Valériane; Ger. Baldriantinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: 75 p. c. alcohol. Dose, ʒss–2 (2–8 cc.).

2. *Tinctura Valerianæ Ammoniata.* Ammoniated Tincture of Valerian. (Syn., Tr. Valer. Ammon., Tinctura Valerianæ Composita; Fr. Teinture de Valériane ammoniacale; Ger. Ammoniakalische Baldriantinktur.)

Manufacture: 20 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: aromatic spirit of ammonia. Dose, ʒss–2 (2–8 cc.).

3. *Fluidextractum Valerianæ, N.F.* (80 p. c. alcohol). Dose, ♏xv–60 (1–4 cc.).

Unoff. Preps.: Abstract, gr. 5–20 (.3–1.3 Gm.). *Extract*, gr. 5–10 (.3–.6 Gm.). *Infusion*, ʒj–2 (30–60 cc.). Syrup. Water (*Aqua*).

PROPERTIES.—Similar to other drugs having a volatile oil. Stimulant, anodyne, nervine, antispasmodic, vermifuge, no narcotic effect; increases heart action and temperature, causing exhilaration, stimulates circulation, secretion, and peristalsis of the stomach and intestines; it is eliminated by kidneys, bronchial and genito-urinary mucous membranes; if used continuously, may produce melancholia, hysteria. Large, doses cause nausea, diarrhea, urination, delirium, lessen motility, sensibility, and reflex excitability; the oil paralyzes the brain, spine, slows pulse, lowers blood-pressure.

USES.—Hysteria, hypochondriasis, hemicrania, nervous coughs, whooping-cough, diabetes, delirium tremens, typhoid state, dysmenorrhea, vertigo, epilepsy, worm convulsions, flatulence, reflex neuralgia.

Allied Plants:

1. *Valeriana Walli'chii, Valerianæ Indicæ Rhizoma* (Br.); India; rhizome 5 Cm. (2′) long, 10 Mm. (⅖′) thick, brown, curved, many root-scars, few thick roots—equivalent to official. *V. Phu′;* W. Asia, S. Europe; tall perennial; rhizome (*Radix Valerianæ Majoris*) is 10–15 Cm. (4–6′) long, 12 Mm. (½′) thick, annulated, brown; *V. mexica'na* and *V. tolucca'na*, Mexico. All three yield valeric acid; odor and taste weaker than official.

2. *V. cel'tica* (*Nardus Spica celtica*).—Alps, and *Nardos'tachys Jataman'si, Nar'dus in'dica* (*Spica nardi*) or true spikenard, India; the former has valerian odor, the latter that of serpentaria.

65. CUCURBITACEÆ. Gourd Family.

Ku-ker-bi-ta'se-e. L. *Cucurbit-a* + aceæ, a gourd, fr. *curvitas*, crookedness—*i. e.*, referring to the fruit's shape. Herbs. Distinguished by possessing acrid, bitter, purgative properties, succulent nature, prostrate or climbing, with tendrils; leaves and stem scabrous; flowers unisexual, calyx 5-toothed, tube adnate to the ovary; corolla 5's, perigynous; stamens mostly 3, usually united; ovary 1–3-celled; inferior; fruit succulent, pulpy, edible; seeds flat, many, exalbuminous; tropics; purgative (pulp), edible, poisonous.

Genera. **1. Ecballium. 2. Citrullus. 3. Cucurbita.**

ECBALLIUM. SQUIRTING CUCUMBER.

Elaterinum. Elaterin, $C_{20}H_{28}O_5$, *U.S.P.*

Ecballium Elaterium, (*Linné*) *A. Richard.* { A substance obtained from the juice of the fruit.

Habitat. W. Asia, N. Africa, S. Europe—Mediterranean Basin, dry waste places; cultivated.

CUCURBITACEÆ

Syn. Squirting or Wild Cucumber, Wild Balsam Apple; Fr. Concombre sauvage, Elatérine, Elatine; Ger. Eselsgurke, Springgurke, Elaterin.

Ec-bal'li-um. L. fr. Gr. ἐκ, out, + βάλλειν, to throw—*i. e.*, the fruit expelling its contents when fully ripe.

El-a-te'ri-um. L. fr. Gr. ἐλατήριον, driving out, purging—*i. e.*, its medicinal property. **El-a-te-ri'num, E-lat'er-in**—both simply derivative names.

PLANT.—Common perennial, squash-like vine; stem trailing, tendril-bearing, succulent, bristly, .6–1.3 M. (2–4°) long; leaves cordate, 7.5–12.5 Cm. (3–5′) long, lobed, hispid, pale green; flowers monœcious, yellow; fruit 5 Cm. (2′) long, 2.5 Cm. (1′) broad, oblong, pale yellowish-green, beset with fleshy prickles, 3-celled, containing bitter, watery, mucilaginous juice in which are many light brown seed.

CONSTITUENTS.—Elaterin 44 p. c., green resin 17 p. c., starch 6 p. c.; prophetin, ecballin (elateric acid), hydroelaterin, elaterid.

FIG. 404.—*Ecballium Elaterium.*

Elaterinum. Elaterin.—Obtained by exhausting elaterium (a substance deposited by the juice of the fruit) with hot alcohol and precipitating with water, or treating with hot chloroform and precipitating with ether, washing with ether and recrystallizing from alcohol or chloroform. It is in minute, white, hexagonal scales, prismatic crystals; odorless; slightly acrid, bitter taste, permanent, soluble in alcohol (325), boiling alcohol (100), chloroform (15.5), ether (450), benzene (310); insoluble in water; alcoholic solution neutral. *Tests:* 1. Solution of .01 Gm. in 5 cc. of melted phenol, + a few drops of sulphuric acid—crimson, rapidly changing to scarlet; incinerate—ash negligible. 2. Shake .1 Gm. with distilled water 9 cc. + diluted hydrochloric acid 1 cc.; to separate portions of filtrate add .5 cc.

mercuric potassium iodide T. S., or iodine T. S.—no turbidity (abs. of alkaloids). *Impurities:* Alkaloids, readily carbonizable substances. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

Adulterations.—Elaterium: Starch, calcium carbonate, various minerals colored green. Owing to this adulteration and the irregular treatment in collecting and curing, it becomes a very uncertain product, hence the official Elaterin is much to be preferred, which as a rule is pure.

Commercial.—Fruit when ripe is yellow and falls to the ground from its attachment, and at the instant of separation the entire contents are expelled violently (hence called squirting cucumber), through the socket or peduncle orifice—due to osmosis from pericarp to central pulp, causing engorgement, therefore tension and rupture at weakest point. Elaterium should be prepared from the fruit collected with the stalk, just before ripe, cutting fruit lengthwise, lightly pressing (best without pressure), straining the juice, setting aside to deposit, and putting this (sediment) on porous tiles to dry by gentle heat, avoiding exposure to the sun. Forty cucumbers without pressure yield 6 gr. (.4 Gm.), and 40 pounds (18 Kg.) yield only 240 gr. (15.5 Gm.). Elaterium occurs in grayish fragments or scales, odor tea-like, taste bitter, acrid; should not effervesce with hydrochloric acid. Dr. Clutterbuck's is considered best.

Preparations.—(*Unoff.*) Elaterin: *Trituration*, 10 p. c., gr. $\frac{1}{2}$–$\frac{3}{4}$ (.03–.05 Gm.). *Pulvis Elaterini Compositus*, 2.5 p. c., gr. 1–4 (.06–.26 Gm.). Elaterium, dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.). *Solution of Elaterium*, $\frac{1}{4}$ p. c., in alcohol + $\frac{1}{2}$ p. c. nitric acid, dose, ♏xxx (2 cc.).

Properties.—Hydragogue cathartic (most powerful known), producing profuse watery evacuations with griping and much prostration; large doses nauseate, vomit, inflame stomach and bowels, increase flow of urine, and may kill. Does not vomit nor purge dogs, rabbits, but kills them by convulsions. Those working in it often have ulcerated fingers, eyes, etc.

Uses.—The fruit was employed by the ancients, being recommended by Dioscorides in mania, melancholia. Sydenham used it in dropsy, but it fell into disfavor through its severity, until brought forward again by Dr. Ferriar. Useful in dropsy, Bright's disease with dropsy (as it is believed to eliminate more urea through the bowels than any other cathartic), brain and lung congestion, uremia, but never in heart disease.

Poisoning.: Same as for aloe, etc. Evacuate stomach, give demulcents, opium, stimulants.

Allied Plants:

1. *Bryo'nia al'ba* or *B. dioi'ca, Bryonia, Bryony, N.F.*—The dried root with not more than 2 p. c. of foreign organic matter; C. and S. Europe. Perennial climbers, the former monœcious, the latter diœcious; leaves heart-shaped, 5-lobed; flowers small, greenish-white or yellowish; fruit, berries, size of a pea, the former black, the latter red (hence

names black and red bryony). Root, spindle-shaped, .3–.6 M. (1–2°) long, lactescent, fleshy, usually in circular slices 1.5–10 Cm. ($\frac{3}{5}$–4′) broad, 3–15 Mm. ($\frac{1}{8}$–$\frac{3}{5}$′) thick, yellowish, whitish, rough, striate, thin cortex, wood with projecting fibro-vascular bundles in concentric zones; fracture short, mealy, whitish; odor faint, distinct, characteristic, taste bitter, nauseous. Powder, light yellow—starch grains, central cleft, tracheal pores, large yellow cork cells; with sulphuric acid—reddish-brown, then brownish-purple; contains alkaloid (amorphous), bryonol (dihydric alcohol)—both purgative, volatile oil, resin, glucoside (inactive), enzyme, sugar, phytosterol; solvents: alcohol, hot water. Hydragogue cathartic, emmenagogue, vesicant, emetic (large doses). Used in dropsy, epilepsy, hysteria, bronchitis, whooping-cough, rheumatism, swollen glands, scabies; large doses poisonous. Dose, gr. 10–60 (.6–4 Gm.); 1. *Tinctura Bryoniæ*, 10 p. c. (alcohol), dose, ♏xv–60 (1–4 cc.). Infusion, 5 p. c., ℥j–2 (30–60 cc.). Mother Tincture (Homeopathic), ♏v–40 (.3–2.6 cc.); Bryonin, gr. $\frac{1}{6}$–$\frac{1}{3}$ (.01–.02 Gm.).

Fig. 405.—*Bryonia dioica.*

2. *Cayapo'nia america'na* (*Bryonia americana*); W. Indies, *Bryonia Kedros'tis na'na* (*africa'na*); S. Africa.—Both in their respective countries are used like bryonia, especially for dropsy; *B. epigæ'a;* India—used natively as an alterative in syphilis, and as a remedy for snake-bites.

3. *Momor'dica Balsam'ina, Balsam Apple*, E. India.—Climbing plant, also cultivated in gardens throughout the United States for its yellow cucumber-like fruit. This is soaked in whisky and used domestically as a vulnerary.

4. *Luf'fa Luffa* (*ægypti'aca,*), Egypt, and *L. opercula'ta*, Brazil, *Vegetable Sponge, Wash-rag Sponge, Gourd Towel. Cu'cumis myriocar'pus;* S. Africa.—These produce analogous fruits, which have similar action to colocynth, while the derma of *Luffa* serves as sponge.

COLOCYNTHIS. COLOCYNTH, *U.S.P.*

Citrullus Colocynthis, *(Linnê) Schrader.* — The dried pulp of unripe but fully-grown fruit with not more than 5 p. c. seed nor 2 p. c. epicarp, yielding not more than 2 p. c. extractive (purified petroleum benzin) nor 6 p. c. acid-insoluble ash.

Habitat. S. and W. Asia, N. and S. Africa, in arid places, deserts; Arabia, Syria, Egypt, Morocco, Cape of Good Hope, Greece, Spain, Japan; cultivated.

Syn. Colocyn., Colocynth Pulp, Bitter Apple, Colocynth Apple (Fruit), Cucumber, or Gourd; Br. Colocynthidis Pulpa, Colocynth Pulp, Poma Colocynthidis; Fr. Coloquinte; Ger. Fructus Colocynthidis, Koloquinthen, Coloquinthenapfel.

Ci-trul'lus. L. *citrus*, an orange, Gr. *κίτρον*, citron, Ar. origin—*i. e.*, named after color of the fruit when cut—orange-red.

Col-o-cyn'this. L. fr. Gr. *κολοκυνθίς*, the classic name of the plant.

Plant.—Perennial tendril-bearing vine; stem angular, hispid, herbaceous; leaves many-lobed, hairy, 2.5–10 Cm. (1–4′) long, subpalmately cleft on long hispid petioles; tendrils, with which it climbs, short, branching; flowers large, monœcious, both kinds similar, solitary, yellow. Fruit, before removing seed, nearly globular, 4–7 Cm. ($1\frac{3}{5}$–3′) broad, size of a small orange, usually more or less crushed and in broken pieces, with occasional patches of nearly smooth epicarp; yellowish-white; light, spongy; separable longitudinally when entire into 3 carpels, each containing, near the outer surface, the ovoid, compressed, yellowish seed; odor slight; taste intensely bitter. Powder yellowish-white, buff and characteristically flaky—fragments of parenchyma and vascular bundles, stone cells, aleurone grains, globules of fixed oil. *Solvents:* alcohol; diluted alcohol; water. Dose, gr. 2–10 (.13–.6 Gm.); laxative, gr. 2–5 (.13–.3 Gm.); drastic purgative, gr. 5–10 (.3–.6 Gm.), repeated in 8–12 hours if necessary.

Commercial.—Plant resembles closely the watermelon (*C. Citrullus* —an annual with larger, smoothish leaves, and much larger sweetish fruit), and has been cultivated in English gardens since 1551. It is a very old medicine, the pulp, constituting 24.5 p. c. of the peeled fruit, being the portion that alone should be used; the separated and rejected seed possess slight bitterness, but also a fixed oil, 12.72 p. c., that, upon removal of testa, renders the kernels (one-half oil) somewhat prized in Africa for food, bread, etc. There are two varieties: 1, *Peeled* (*Turkey*), the smaller, best, usually from the maritime plain between the mountains of Palestine and the Mediterranean; shipped chiefly from Jaffa, Trieste, that from Spain being smaller, darker, more compact, less pulp, blackish seed; 2, *Unpeeled* (*Mogador*), the larger, inferior, covered with smooth, yellowish-brown firm rind. Fruit is gathered in autumn when turning yellow, peeled (or this, if to be done, may be deferred until after drying) and dried quickly by sun or fire; not known or used by native physicians as a cathartic, but simply as a protection against moths.

CONSTITUENTS.—Pulp 24.5 p. c., Seed 75.5 p. c. Pulp contains colocynthin 2 p. c., Colocynthitin, pectin, gum (no starch), ash 15 p. c.; seed contain alkaloid (trace), fixed oil 12.72 p. c., albuminoids 6 p. c., ash 2–4 p. c. (whole fruit 4–5 p. c.).

FIG. 406.—*Citrullus Colocynthis.*

Colocynthin, $C_{56}H_{84}O_{24}$.—The chief cathartic principle; an amorphous glucoside (bitter principle), obtained by exhausting with water the alcoholic extract, precipitating filtrate with lead acetate and subacetate; the yellow filtered liquid is treated with H_2S to remove lead, filtered, then precipitated with tannin. This tannate of colocynthin is dissolved in alcohol, the tannin thrown down by lead subacetate, filtered liquid digested with animal charcoal, filtered, evaporated. It

is a yellow powder, soluble in water, alcohol, boiled with diluted acids splits into sugar and resinous colocynthein. Dose, gr. ½–1 (.03–.06 Gm.)—hypodermically, gr. ⅙–⅓ (.01–.02 Gm.), by which method it is painful, and should be associated with cocaine. The "Eclectic" resinoid, *colocynthin*. Dose, gr. ¼–1 (.016–.06 Gm.).

Colocynthitin (*citrullin*).—A resin left after treating alcoholic extract with cold water in preparing colocynthin; occurs in white, tasteless microscopic prisms, soluble in ether, hot alcohol.

PREPARATIONS.—1. *Extractum Colocynthidis.* Extract of Colocynth. (Syn., Ext. Colocyn., Powdered Extract of Colocynth, Extractum Colocynthidis Alcoholicum; Fr. Extrait de Coloquinte; Ger. Koloquinthenextrakt.)

Manufacture: Macerate, percolate 100 Gm. with diluted alcohol until exhausted (500 cc.), reclaim alcohol, evaporate residue to dryness, pulverize, add dried starch q. s. 25 Gm.; mix thoroughly, pass through fine sieve; 1 Gm. represents 4 Gm. of the drug. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. ½–2 (.03–.13 Gm.).

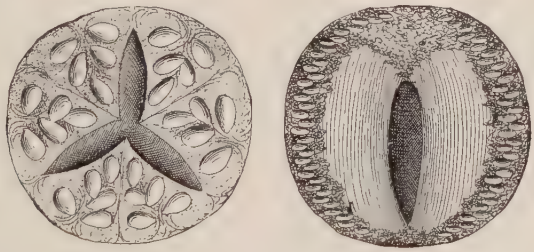


FIG. 407.—Peeled colocynth: transverse and longitudinal sections.

Prep.: 1. *Extractum Colocynthidis Compositum.* Compound Extract of Colocynth. (Syn., Ext. Colocyn. Co., Powdered Compound Extract of Colocynth; Fr. Extrait de Coloquinte composé; Ger. Zusammengesetztes Koloquinthenextrakt.)

Manufacture: Triturate together until No. 60 powder, extract of colocynth 16 Gm., aloe 50, cardamom seed 5, resin of ipomœa 14, soap (dried powder) 15, pass through fine sieve. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

Preps.: 1. *Pilulæ Hydrargyri Chloridi Mitis Compositæ,* 1¼ gr. (.075 Gm.). 2. *Pilulæ Catharticæ Vegetabiles, N.F.,* 1 gr. (.06 Gm.)—ext. colocyn. co. 6 Gm., ext. hyosc. 3, res. jalap 2, ext. leptand., res. podoph. āā 1.5, ol. menth. pip. .8, alcohol dil. q. s. 100 pills, Dose, 1.3 pills.

Unoff. Preps.: Fluidextract, dose, ♏ij–10 (.13–.6 cc.). *Tincture,* 10 p. c. (alcohol), ℥ss–1 (2–4 cc.).

CUCURBITACEÆ

PROPERTIES.—Drastic and hydragogue cathartic, hepatic stimulant, diuretic; small doses bitter, stomachic; large doses emetic, irritant poison, causing violent griping, dangerous bowel inflammations—gr. 90 (6 Gm.) have killed.

USES.—The Greeks and Arabians were unacquainted with its drastic effect, but prescribed it for its other properties. Now used as an evacuant, dropsy, melancholia, coma, apoplexy, paralysis, but never in pregnancy, nor where gastric or intestinal inflammation is present. It is very harsh and seldom used alone.

Poisoning: Same as for aloe, etc. Evacuate stomach, give demulcents, opium, stimulants.

PEPO. PEPO, *U.S.P.*

Cucurbita Pepo, *Linné.* { The dried ripe seed of cultivated varieties with not more than 5 p. c. broken or defective seeds, or other foreign organic matter.

Habitat. Tropical Asia, America; cultivated.

Syn. Pumpkin Seed, Pumpkin, Pompion, Cold Seeds, Semen Peponis, Semina Cucurbitæ; Br. Cucurbitæ Semina Præparata; Fr. Semences de Potirons; Ger. Kürbissamen.

Cu-cur'bi-ta. L. see etymology, page 597, of Cucurbitaceæ.

Pe'po. L. fr. Gr. πέπων, pumpkin, old form, pompon, lit. cooked by the sun, ripe, mellow—*i. e.*, not eaten until ripe.

PLANT.—Trailing annual; stem rough, hollow, hairy, 3–9 M. (10–30°) long, tendrils branched; leaves large, .25–.5 M. (10–20′) long, 15–30 Cm. (6–12′) wide, obtusely cordate, hispid, palmately 5-lobed, serrate, petioles 7.5–20 Cm. (3–8′) long; flowers July, large, 5–12.5 Cm. (2–5′) wide, yellow, bell-shaped, monœcious, axillary; anthers 3, syngenesious; fruit Oct., large, round, oblong, smooth, fleshy, yellow, furrowed, .25–.5 M. (10–20′) in diameter. SEED, broadly elliptical, ovate, 15–23 Mm. ($\frac{3}{5}$–$\frac{5}{6}$′) long, 6–9 Mm. ($\frac{1}{4}$–$\frac{3}{8}$′) broad, 2–3 Mm. ($\frac{1}{12}$–$\frac{1}{8}$′) thick; yellowish-white, smooth, occasionally with thin transparent fragments of adhering pulp, shallow groove parallel to and within 1 Mm. ($\frac{1}{25}$′) of the margin; fracture short, seed-coat consisting of a white coriaceous outer layer and a membranous inner layer (sometimes dark green); embryo whitish, straight with small conical hypocotyl and 2 plano-convex cotyledons; slightly odorous when contused; taste bland, oily. POWDER, yellowish-white,—epidermal cells, stone cells, parenchyma cells, endosperm cells with aleurone grains, cotyledons with cells containing fixed oil and many small aleurone grains; integuments 21 p. c., kernel 79 p. c. *Solvent:* alcohol. Dose, ʒj–2 (30–60 Gm.).

CONSTITUENTS.—Resin (yielding phytosterin, etc.) .5 p. c. Fixed oil 30 p. c., proteins (myosin, vitellin), cucurbitine (?), salicylic acid, sugar, ash 3–4 p. c.

Resin.—Probably the active principle, residing in the tegmen or embryo, obtained by treating the seed, after the removal of fixed oil, with alcohol, ether, chloroform; it is soft, greenish-brown, acrid, bitter. Dose, gr. 15 (1 Gm.).

Fixed Oil.—Claimed to possess (℥iv; 15 cc.) the medicinal power of the drug, due no doubt to the presence of some resin, and is obtained by expression, or by treating seed with benzin; consists of the glycerides of oleic, myristic, and palmitic acids. The seed-infusion saturated with sodium chloride precipitates myosin, and when CO_2 is added vitellin separates, which behaves like egg-yolk (due to its contained vitellin); the protein is possibly its emulsionizing principle.

PREPARATIONS.—(Unoff.): *Fluidextract*, dose, ℥ss–1 (15–30 cc.). *Emulsion* (℥ij–4; 60–120 Gm. fresh seed, deprived of testa, should be beaten into a paste with sucrose + water or milk Oj; .5 L.), dose, ℥v (150 cc.) at 2-hour intervals beginning at 10 o'clock A.M. Patients should remain quietly in bed all day; on the night before, and also before breakfast, give saline purgative to remove mucus, and about 3–4 hours after the pint (.5 L.) has been taken administer castor oil ℥j–2 (30–60 cc.). Should fast the day previous to taking the medicine.

Fig. 408.—*Cucurbita Pepo.*

FIG. 409.—Pumpkin seed; entire and longitudinally divided, showing embryo.

PROPERTIES AND USES.—Tenifuge, vermifuge, diuretic, valuable because of its freedom from taste and harshness of action, but has the disadvantage of uncertainty. Same treatment applies to tape- and lumbricoid worms.

Allied Plant:

1. *Citrul'lus Citrullus (vulgaris)—Cucurbita (Cu'cumis) Citrullus, Watermelon Seed.*—S. Asia; cultivated. Fruit edible, very large; seed flat, ovate, 12 Mm. ($\frac{1}{2}'$) long, blackish, marbled, or orange-brown, ungrooved, blunt on the edge, otherwise like pumpkin seed. Kernels contain fixed oil 7.4 p. c., petroleum benzin extract 19 p. c., proteins, sugar, resin (cucurbitol—closely related to grindelol and ipurganol); diuretic, tenifuge, anthelmintic. Dose, ℥ij–16 (8–60 Gm.).

66. CAMPANULACEÆ. Bell-flower Family.

Kam-pan-u-la'se-e. L. *Campanul-a* + aceæ, dim. of *campana*, a bell—*i. e.*, from the resemblance of the corolla. Herbs, shrubs. Dis-

CAMPANULACEÆ

tinguished by alternate exstipulate leaves; acrid and usually milky juice; solitary perfect flowers, calyx 5-lobed, corolla gamopetalous, campanulate or rotate, limb 5-lobed, stamens separate or synegenesious; ovary 2–5-celled, inferior; fruit capsule or berry; temperate climates; emetic, diaphoretic, narcotic.

Genus: **1. Lobelia.**

LOBELIA. LOBELIA, *U.S.P.*

Lobelia inflata, *Linné.* — The dried leaves and tops with not more than 10 p. c. stems, nor 2 p. c. other foreign organic matter, yielding not more than 5 p. c. acid-insoluble ash.

Habitat. N. America (Canada, United States), in fields and open places.

Syn. Lobel., Indian Tobacco, Wild Tobacco, Green, Brown, Bladder-podded Lobelia, Emetic Herb (Weed), Asthma (Puke) Weed, Gag Root, Vomit Wort, Low Belia, Eyebright; Fr. Lobélie enflée; Ger. Herba Lobeliæ, Lobelienkraut.

Lo-be'li-a. L. after Matthias de Lobel, Flemish botanist, physician, and author of several botanical works, 1538–1616, native of Lille, became physician and botanist to James I., died in London.

In-fla'ta. L. *inflatus*, inflated, swollen—*i. e.*, seed are borne in egg-shaped inflated pod.

Plant.—Annual herb, .3–.6 M. (1–2°) high, erect, paniculately branched; stem cylindrical, coarsely and irregularly furrowed, yellowish green, occasionally purplish, pubescent with numerous spreading hairs; root fibrous. Leaves, alternate, ovate, oblong, 2–9 Cm. ($\frac{4}{5}$–$3\frac{3}{5}'$) long, sessile or narrowing into a short petiole, obtusely toothed, irregularly serrate-denticulate, each tooth with a yellowish-brown, gland-like apex; pale green with scattered, bristly hairs; flowers blue, long, loose racemes with short pedicles, calyx tube ovoid with 5 subulate teeth, corolla tubular, 3–4 Mm. ($\frac{1}{8}$–$\frac{1}{6}'$) long, 5-parted, the upper 2-lobed portion cleft nearly to the base; stamens with anthers united above into a curved tube enclosing the bifid stigma; capsules inflated, ovoid, ellipsoidal, 5–8 Mm. ($\frac{1}{5}$–$\frac{1}{3}'$) long, light brown, inferior, enclosing numerous coarsely reticulate seed; odor slight, irritating; taste strongly acrid. Powder, dark green, odor irritating—fragments of seed-coat composed of polygonal cells with thick yellowish walls; occasional elongated-conical, non-glandular hairs; fragments of stem with tracheæ having thickenings, pores, narrow wood-fibers with thin, lignified porous walls; fragments of leaf epidermis with elliptical stomata, pollen grains nearly spherical. Loses on drying 75 p. c. *Solvents:* diluted alcohol; boiling water. Dose, expectorant, gr. 1–5 (.06–.3 Gm.); emetic, gr. 10–20 (.6–1.3 Gm.).

Adulterations.—Rare—except its own stems and roots.

Commercial.—Lobelia was popular with the North American Indians, but Dr. Cutler, of Massachusetts, introduced it into our medical practice. It should be collected Aug.-Sept., carefully dried, and sold loosely or in various-sized compressed packages; powder keeps well.

Constituents.—Lobeline, Lobelacrin, Lobelic acid, Inflatin, a second alkaloid (?), resin, wax, volatile oil (lobelianin), fixed oil (seed) 30 p. c., gum, ash 8 p. c.

Lobeline.—Obtained by evaporating to syrup the acetic-alcoholic tincture (preferably of seed), triturating this with magnesium oxide in excess, agitating filtrate with ether, evaporating, getting impure alkaloid. It is a yellow, aromatic liquid, acrid taste, convertible into amorphous powder and non-crystalline salts (hydrobromide, sulphate, etc.) soluble in water. Dose (sulphate), gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

Lobelacrin.—Obtained by concentrating tincture in the presence of charcoal, washing with water, exhausting with boiling alcohol; it is the acrid principle—possibly lobelate of lobeline, brown, soluble in ether or chloroform, splitting with dilute acids or alkalies into sugar and lobelic acid.

Lobelic Acid.—Obtained by precipitating decoction of leaves with copper sulphate, and decomposing with hydrogen sulphide; it is colored olive-brown by ferric salts.

Inflatin.—Neutral principle (wax), tasteless crystals, no medicinal value.

Fig. 410.—*Lobelia inflata.*

Fig. 411.—Lobelia flower and section: magnified 5 diam.

Preparations.—1. *Tinctura Lobeliæ.* Tincture of Lobelia. (Syn., Tr. Lobel.; P. I. Lobeliæ tinctura; Fr. Teinture de Lobélie; Ger. Lobelientinktur.)

Manufacture: 10 p. c. Similar to Tinctura Veratri Viridis, page 104; menstruum: diluted alcohol. Dose, ♏v–30—60 (.3–2—4 cc.).

2. *Fluidextractum Lobeliæ, N.F.* (1st menstruum:—acetic acid 5 cc., alcohol 50, water 45; 2d—diluted alcohol), Dose, ♏j–5—20 (.06–.3—1.3 cc.).

Unoff. Preps.: Acetum, 10 p. c., ♏v–60 (.3–4 cc.). *Extract*, gr. ½–2 (.03–.13 Gm.). *Infusion*, 5 p. c., ℥ss–1 (15–30 cc.). *Tinctura Lobeliæ Ætherea* (Br.), 20 p. c. (spirit of ether), ♏v–15 (.3–1 cc.). The "Eclectic" *lobelin*, made in the usual way, is an impure resinoid, gr. ½–1 (.03–.06 Gm.).

PROPERTIES.—Expectorant, emetic, nervine, purgative, narcotic, diuretic, diaphoretic; similar to ipecac, but causes more distressing nausea and intense prostration; it paralyzes the motor nerves, vasomotor center, and peripheral vagi. Leaves chewed a short time cause giddiness, headache, tremors, nausea, vomiting; full doses give speedy and severe vomiting, general relaxation, cold skin with sweating; resembles tobacco, is dangerous, having caused many deaths.

USES.—Spasmodic asthma, catarrh, croup, bronchial spasms, whooping-cough, in enema for intussusception, strangulated hernia, constipation—when feces hard and dry; externally for poison-ivy (oak) eczema. Should not be given as an emetic, and is too depressing for children.

Poisoning: Have burning pain in fauces, esophagus, motor weakness, great depression, feeble pulse, low temperature, anxious, livid countenance, contracted pupils, vertigo, tremors, cold sweat, pale skin, sometimes violent purging, collapse, stupor, coma, death from respiratory failure. Place in recumbent position, empty stomach if vomiting has not been free, give tannin, cardiac and respiratory stimulants, strychnine, picrotoxin, thebaine, alcohol, digitalis, atropine or belladonna, digitalis, morphine, artificial heat, ergot, castor oil.

Incompatibles: Strychnine, picrotoxin; caustic alkalies decompose lobeline, making preparations inert.

Synergists: Emetics, motor depressants.

Allied Plants:

1. *Lobelia syphilit'ica, Great Lobelia.*—Stem .6–1 M. (2–3°) high; flowers large, 2.5 Cm. (1′) long, beautiful blue; diaphoretic. Used by the aborigines for syphilis.

2. *L. cardina'lis, Cardinal-flower.*—Stem .6–1.3 M. (2–4°) high; flowers large, showy, intense cardinal or scarlet-red. Used by Indians as anthelmintic; similar to *L. syphilitica*, but milder.

67. COMPOSITÆ. Composite (Thistle) Family.

Kom-poz'i-te. L. *Composit-us* + æ, pp. of *componere*, compounded —*i. e.*, referring to the two kinds of florets (ray and disk) composing each flower-head. Herbs, shrubs. Distinguished by being the largest family, by possessing bitter principles, watery or resinous (rarely milky) sap; flowers (florets) 5's, in compound heads surrounded by involucre; calyx superior, tube adnate to ovary, limb often pappose or membranous; corolla epigynous, usually 5-lobed, stamens 5, epipetalous, syngenesious; ovary inferior, 1-celled; ovule 1, erect; fruit achene; universal; tonic, laxative, anthelmintic (bitter principle), aromatic, carminative, diaphoretic, stimulant (volatile oil).

Genus: **1. Artemisia.**

SANTONICA. SANTONICA.

Santoninum. Santonin, $C_{15}H_{18}O_3$, *U.S.P.*

Artemisia pauciflora, (*Ledebour*) *Weber.* — The inner anhydride (lactone) of santoninic acid, obtained from the dried unexpanded flower-heads (santonica).

Habitat. N. Turkestan, Russia, on the vast plains of Kirghiz.

Syn. Levant Wormseed, Aleppo, Alexandria or European Wormseed, Tartarian Southern Wood, Semen Santonici—Cinæ—Sanctum—Contra; Anhydrous Santoninic Acid; Fr. Semen-contra d'Alep, Barbotine; Santonine, Lactone santonique; Ger. Flores Cinæ, Zitwerblüten(samen), Wurmsamen; Santonin.

Ar-te-mis'i-a. L. fr. Gr. Ἀρτεμις, the goddess; Roman Diana, to whom *Artemisia Absinthium* was dedicated, owing to its use in hastening puberty.

Pau-ci-flo'ra. L. *paucus*, few, + *florus*, flower—*i. e.*, has few blooms, mostly only buds.

San-ton'i-ca. L. *santonicus*, pertaining to the Santoni, people of Aquitania (Gr. σαντονικόν, their wormwood), named in commemoration, which name survives to the place Saintes, in France.

Plant.—Small, semi-shrubby, perennial, with knotty, fibrous rootstocks, branching from crown, from which many erect, flowering stems arise, .3 M. (1°) high; stems 6–8, woolly or glabrous, at first leafy; leaves bipinnatisect, 12 Mm. ($\frac{1}{2}'$) long, woolly when young, afterward grayish. Flowers, 2–4 Mm. ($\frac{1}{12}$—$\frac{1}{6}'$) long, 1 Mm. ($\frac{1}{25}'$) wide, oblong-ovoid, slightly flattened, obtuse, smooth, glossy, grayish-green, after exposure to light—brownish-green, consisting of an involucre of 12–18 closely imbricated, glandular scales, with broad midribs, enclosing 4–5 rudimentary florets; odor strong, peculiar, camphoraceous; taste aromatic, bitter. *Solvents:* diluted alcohol; hot water partially. Dose, gr. 15–60 (1–4 Gm.).

Constituents.—Santonin 2.5–3.5 p. c., Volatile oil 2–3 p. c., artemisin, $C_{15}H_{18}O_4$ (in santonin mother-liquor, recrystallizing pure from chloroform), resin, gum, ash 7 p. c.

Santoninum. Santonin.—Discovered in 1830, and may be obtained by mixing powdered santonica (5) with slaked lime (1), exhausting with hot water, concentrating filtered solution containing calcium santonate, decomposing with hydrochloric acid, giving calcium chloride in solution, and santonin precipitated along with resinous matter, from which freedom may be obtained by washing with dilute ammonia water, or recrystallizing from hot alcohol. It is in colorless, shining, flattened rhombic prisms, crystalline powder, odorless, nearly tasteless at first, afterward developing bitterness, permanent; yellow on exposure to light, which may be converted into colorless crystals by recrystallization from alcohol, soluble in alcohol (43), boiling alcohol (6.5), chloroform (1.7), ether (110), slightly in water or boiling water; solutions levorotatory, melts at 170° C. (338° F.). *Tests:* 1. Heat .2 Gm. with 2 cc. of alcoholic potassium hydroxide T. S.—red color; inciner-

ate—ash .1 p. c. 2. Shake .01 Gm. with a cooled mixture of sulphuric acid and distilled water, each 1 cc., heat to boiling, add 1 drop of dilute ferric chloride solution (1 in 10)—violet color. *Impurities:* Alkaloids, readily carbonizable organic substances. Should be kept dark, in well-closed containers. Dose, gr. 1–4 (.06–.26 Gm.); child, gr. ¼–1 (.016–.06 Gm.).

Fig. 412. — Santonica: head and longitudinal section, magnified 10 diam.

Volatile Oil.—Obtained by distilling with water or steam; yellowish, disagreeable odor; consists mainly of cineol, $C_{10}H_{18}O$, some dipentene, sp. gr. 0.930, when shaken with iodine get greenish crystals.

Adulterations.—Santonica: Mustard hulls (large brown fragments recognized by microscope), exhausted birch bark. Santonin: Salicin, boric acid, strychnine, picric acid. With sulphuric acid at first colorless (abs. of salicin, which turns red). Boric acid insoluble in chloroform, non-volatile—green color to alcohol flame, and heated upon foil—glassy mass, the solution of which turns turmeric paper brown. Picric acid—explodes by heat or percussion; forms yellow salts and precipitates gelatin in aqueous solution.

Commercial.—The source *Artemisia marit'ima* var. *pauciflora* is preferred by some writers, although it has escaped far from its original maritime habitat. Flowers exposed to light and air soon become brown and inactive, hence should be preserved in tight containers. There are two varieties: 1, *Aleppo, Alexandria, Levant,* collected July–August, forwarded to the great fair of Nizhnee-Novgorod, and thence to market via Moscow, Leningrad (Petrograd, St. Petersburg), W. Europe; 2, *Barbary* (*A. Siebe'ri,* + *A. ramo'sa*), rarely met here, as it (flowerheads) does not contain santonin.

Preparations.—1. *Tabellæ Santonini, N.F.,* gr. ½ (.03 Gm.) each—santonin 3 Gm., gluside .06, cocoa 6, sucrose 21, tr. vanill. 1.5 cc.: compress 100 tablets, dose, 1–2 tablets. 2. *Tabellæ Santonini Compositæ, N.F.,* ½ gr. (.03 Gm.) each—santonin 3 Gm., mild mercurous chloride 3, gluside .06, cocoa 6, sucrose 18, tr. vanill. 1.5 cc.: compress 100 tablets, dose, 1–2 tablets. As both tablets suggest candy, physicians should not order more than 3, since 2 gr. (.13 Gm.) has caused the death of a 5-year-old child.

Unoff. Preps.: Flower-heads: Electuary. Extract. Infusion. Santonin: *Trochiscus Santonini* (Br.) 1 gr. (.06 Gm.). *Sodium Santoninas,* U.S.P. 1880, gr. 2–10 (.13–.6 Gm.). *Trochisci Sodii Santoninatis,* U.S.P. 1880, 1 gr. (.06 Gm.), 1–4 troches. *Santoninic Acid,* gr. 1–4 (.06–.26 Gm.).

Properties.—Anthelmintic, stimulant, emmenagogue. The Crusaders introduced santonica into Europe, and it has been used there ever since, mostly now as santonin. It is absorbed as sodium santoninate, and eliminated by the kidneys; large doses dilate pupils, cause

gastric oppression, nausea, vomiting, diarrhea, thirst, cold, clammy skin, giddiness, cerebral congestion, yellow vision (xanthopsia) changing to purplish-red, convulsions, death. Santonin in gr. 5 (.3 Gm.) doses is a strong diuretic, imparting to normal acid urine a saffron color (as does rhubarb), which, by age, hence alkalinity, becomes violet-purple.

Uses.—For round worms (*Ascaris lumbricoides*), sometimes for thread-worms (*Oxyu'ris vermicula'ris*), but never for tape-worm. Santonin kills the round worms that inhabit the small intestine; therefore, purgatives having specific action here should be selected. Give the powder in honey, molasses, to which calomel or jalap has been added, at bedtime, having fasted that day; follow this next morning, before food, with a draught of senna (infusion) or a dose of castor oil; a suppository is serviceable for thread-worms; may reserve entire cathartic until next morning if desirable. Useful in incontinence of urine, eye affections due to inflammatory changes of optic nerve and retina. Never give to children with fever nor while constipated, owing to possible toxic results, which are combatted by ammonia, strychnine, eliminants, artificial respiration. *A. ramo'sa, Barbary Wormseed,* N. W. Africa—unexpanded flower-heads rounder than those of *A. pauciflora,* and covered with whitish down, by which they may readily be recognized; *Indian Wormseed,* Europe, are only half the size of santonica, hairy and more yellow; *American Wormseed* (Chenopodium), in spite of slight resemblance, are often substituted for santonica.

Fig. 413.—*Artemisia Absinthium.*

Allied Plants:

1. *Artemisia Absin'thium, Absinthium, Wormwood.*—The dried leaves and flowering tops with not more than 5 p. c. of foreign matter, U.S.P. 1830–1890; Europe, N. Asia, N. Africa. Perennial herb; stem .6–1 M. (2–3°) high. Leaves, 2.5–7.5 Cm. (1–3′) long, hoary, grayish-green; flowers, in heads, racemose, subglobose, with involucre, receptacle convex, hairy; florets yellow; fruit achene, obovoid without pappus; odor aromatic; taste very bitter. Powder, brownish, yellowish-green; solvents: diluted alcohol, water partially; contains volatile oil 1 p. c., absinthin, anabsinthin, tannin, resin, absinthic (succinic) acid, salts, ash 7–10 p. c. Tonic, stomachic, stimulant, febrifuge, anthelmintic; used for atonic dyspepsia, lumbricoid worms; oil in form of *absinthe liqueur* (oil + anise oil + alcohol) as a narcotic, stimulant in cerebral exhaustion, alone locally as an anesthetic for rheumatism, neuralgia. Dose, gr. 15–60 (1–4 Gm.); infusion, 5 p. c., ℥j–2 (30–60 cc.; tincture, 20 p. c. (diluted alcohol), ʒj–2 (4–8 cc.).

COMPOSITÆ

2. *A. Abrot'anum, Southern-wood, Old Man.*—Asia, Europe; hairy, segments of the pinnatifid leaves capillaceous, lemon odor. *A. vulga'ris, Mugwort,* Africa, Europe, spontaneous in United States; stem purple; epilepsy, amenorrhea. *A. gnaphalo'des* (*A. Ludovicia'na* var. *gnaphalo'des*), *Western Mugwort,* Mich. to Oregon; febrifuge. *A. abyssin'ica,* Abyssinia; has woolly involucre, whitish florets; aromatic odor.

3. *Leon'todon Tarax'acum, Taraxacum, Dandelion, N. F.* The dried rhizome and roots with not more than 2 p. c. of foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; Europe, naturalized in N. America. Perennial acaulescent herb; leaves radical, 15–22.5 Cm. (6–9′) long, 5–7.5 Cm. (2–3′) broad, toothed (runcinate), 5–6 teeth on a side, sessile; flowers golden-yellow, closing at night, terminal upon hollow scape; fruit achene, compressed; spreading pappus on stalk —for dissemination. Rhizome, cylindrical, somewhat flattened, gradually tapering, usually in broken pieces, 6–15 Cm. ($2\frac{2}{5}$–6′) long, 5–15 Mm. ($\frac{1}{5}$–$\frac{3}{5}$′) thick, brownish, longitudinally wrinkled, numerous root- and rootlet-scars; crown simple, branched, with many leaf-bases showing annulate markings; bark 2–6 Mm. ($\frac{1}{12}$–$\frac{1}{4}$′) thick, composed of concentric layers of laticiferous vessels and sieve tissues, alternating with whitish inulin-bearing parenchyma; odor slight, inodorous, taste bitter. Powder, light brown—parenchyma cells large, thin-walled containing irregular masses of inulin; fragments with yellowish-brown laticiferous vessels, tracheæ reticulate, intermediate fibers non-lignified, with pores, no starch; solvents: diluted alcohol, boiling water; contains milk juice (taraxacin, taraxacerin, 2 resins, glutinous body), reducing

Fig. 414.—*Leontodon Taraxacum.*

Fig. 415.—*Leontodon Taraxacum:* rhizome revealing at head the remnants of flower stalks and leaf stalks.

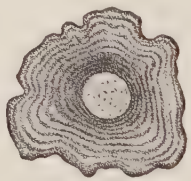


Fig. 416.—Taraxacum: transverse section of root.

sugars, levulin, inulin (yellow with iodine) 24 p. c., pectin, ash 5–10 p. c. Diuretic, tonic, stomachic, aperient, deobstruent; congestion of liver, spleen, dyspepsia, constipation, skin affections, dropsies. *Adulterations:* Chiefly chicory, *Cichorium Intybus*, which, however, is paler and with milk vessels in radiating lines—not concentric. Subject to insect attack, and should be kept in tightly closed containers. Dose, ʒss–2 (2–8 Gm.); 1. *Extractum Taraxaci* (12.5 p. c. alcohol), dose, gr. 5–30 (.3-2 Gm.); 2. *Fluidextractum Taraxaci* (glycerin 10, alcohol 50, water 40, + diluted alcohol), dose, ʒss–2 (2–8 cc.).

Preps.: 1. *Elixir Taraxaci Compositum*, 3.5 p. c. + fldext. prun. virg. 2, fldext. glycyrrh., tr. aurant. dulc. āā 6, +, dose, ʒj–2 (4–8 cc.).

Preps.: 1. *Elixir Eriodict. Arom.*, 44 p. c. 2. *Elixir Guaranæ*, 60 p. c. 3. *Elixir Viburni Opuli Compositum*, 70 p. c.

2. *Elixir Gentianæ Glycerinatum*, 15 p. c. Decoction 5 p. c., ʒj–2 (30-60 cc.). *Succus Taraxaci* (Br.), expressed juice 3, alcohol 1, ʒj–2 (4–8 cc.).

4. *Cicho'rium In'tybus*, *Chicory.*—Europe, naturalized in United States. Root with laticiferous vessels radiate, also is whiter, more woody, and has thinner bark than taraxacum. July collection contains 36 p. c. of inulin, bitter principle, etc., and has properties similar to taraxacum root, with which it often is mixed as an adulterant. Roasted root is used frequently to adulterate coffee. *C. Endiv'ia, Endive;* Levant; cultivated for its bitter leaves.

Fig. 417.—*Cichorium Intybus.*

Fig. 418.—Cichorium: transverse section.

5. *Lactu'ca viro'sa*, *Lactucarium*, *Wild Lettuce.*—The dried milk-juice, U.S.P. 1820–1910; C. and S. Europe. Biennial herb .6–2 M. (2–6°) high, glabrous, green, often purple spotted; leaves runcinate, radical and cauline, spinous apex and margin, auriculate, glaucous-green, flowers yellowish, milk-juice (lactucarium) usually in quarter sections, angular pieces, brownish, fracture tough, waxy; internally light brown, porous; odor distinctive, opium-like; taste bitter. Powder, brownish—irregular fragments without cellular structure. It is

obtained by cutting off the head of each stalk and scraping the exuding juice into small vessels, repeating the process 6–7 times daily for several weeks, each cut being made a little lower down the stalk; by night, having become a viscid mass, it is divided into suitable pieces and dried by gentle artificial heat for 5 days, losing 75 p. c. in weight; solvents: water (51 p. c.), diluted alcohol (36–44 p. c.), spirit of chloroform (55–60 p. c.), being mostly lactucerin; contains lactucerin (lactucon) 50–60 p. c., lactucin, lactucic acid, lactucopicrin, caoutchouc, resin, volatile oil, ash 10 p. c. With water—turbid mixture; + iodine T. S.—not colored blue (abs. of starch); + ferric chloride T. S.—only faint green (abs. of tannin). There are three varieties: 1, English; 2, German; 3, French (Aubergier's). The juice of *L. sati'va*, obtained like lactucarium, yields *Lactucarium Gallicum*, and when expressed from the stalks, clarified by coagulation, expressed and inspissated—*Thridace*. Anodyne, sedative, hypnotic, diuretic, expectorant, very unreliable; milder than opium, and, unlike it, does not derange the digestive organs; where opium is objectionable—to procure sleep, allay cough, dropsy, palpitation of heart, nervousness. Dose, gr. 1–8—15 (.06–.5—1 Gm.); *Tincture*, 50 p. c., dose, ʒss–1 (2–4 cc.); *Syrup*, 5 p. c., dose, ʒj–4 (4–15 cc.; *Fluidextract*, dose, ♏j–30 (.06–2 cc.); *Lozenge*. *L. canaden'sis* (*elonga'ta*), *Wild Lettuce*, U.S.P. 1820–1840. The herb; N. America, rich damp soil, fields, thickets; herb 1.3–3 M. (4–10°) high, hollow, purple, leafy, glaucous; leaves 15–30 Cm. (6–12′) long, pinnatifid; flowers yellow to purple, heads 20-flowered, panicles. Juice from plants in flower make good lactucarium, that collected in early season being without bitterness. *L. sati'va*, *Garden Lettuce*, yields a juice that is medicinal and more abundant in wild than cultivated plants; highly valued as salad and as such is a feeble hypnotic. *L. sagitta'ta* (*altis'sima*), large Caucasian plant 2.5–3 M. (8–10°) high, chiefly cultivated in France.

FIG. 419.—*Lactuca virosa*.

6. *Grindelia campo'rum*, or *G. cuneifo'lia*, *G. squarro'sa*, *Grindelia*, *Gum-plant*, *N.F.*—The dried leaves and flowering tops with not more than 10 p. c. of stems over 2 Mm. ($\frac{1}{12}$′) thick, or 2 p. c. of other foreign organic matter; N. America, west of Rocky mountains. Plants—small perennial, woody herbs, .3–1 M. (1–3°) high, bushy; stems and branches cylindrical, yellowish, pinkish, alternate leaf-scars and basal portions of leaves, sometimes flexuous and coated with resin, terminating in resinous flower-heads; leaves usually separate and broken, oblong, oblong-spatulate, 1–7 Cm. ($\frac{2}{5}$–3′) long, sessile, or amplexicaul, serrate, yellowish-green, resinous, coriaceous, brittle; flower-heads 5–20 Mm.

($\frac{1}{5}$–$\frac{4}{5}$′) broad, urceolate, resinous, involucre bracts numerous, imbricated with recurved tips; ray-florets yellowish-brown, ligulate and pistillate; disk-florets yellow, perfect, pappus of 2–3 linear awns; disk achenes ovoid, oblong, angled, irregular summit; odor balsamic; taste aromatic, bitter, resinous. Powder, yellowish-brown—numerous fibrous fragments bearing tracheæ with thickenings or pores, lignified wood-fibers, pith cells with protoplasm bearing spheroidal granules; fragments of leaf epidermis with polygonal areas, chloroplastids, glandular hairs, spherical pollen grains; solvent: alcohol; contains resin (activity), bitter principle 1–2 p. c., volatile oil, grindeline, fixed oil, tannin 1.5 p. c., ash 7–8 p. c. Cardiac tonic (slows heart action), expectorant, antispasmodic, diuretic; asthma, bronchitis, whooping-cough, catarrh of bladder and uterus, poisoning by rhus toxicodendron—in solution or poultice. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Grindeliæ* (75 p. c. alcohol), dose, ♏xv–60 (1–4 cc.). Extract, gr. 5–15 (.3–1 Gm.). Infusion. Tincture. *G. glutino'sum*, stem often purplish, tomentose, and *G. hirsu'tula*, W. United States, being very similar, are often collected and mixed with commercial drug.

Fig. 420.—*Eupatorium perfoliatum:* flowering top.

7. *Eupato'rium perfolia'tum*, *Eupatorium*, *Thoroughwort*, *Boneset*, *N.F.*—The dried leaves and flowering tops with not more than 10 p. c. of stems nor 2 p. c. of foreign organic matter; N. America, swamps, meadows, banks. Hairy perennial, .6–1.2 M. (2–4°) high, branched at summit; usually more or less broken. Leaves opposite, the pair united at the base, 8–20 Cm. (3–8′) long, 1.5–5 Cm. ($\frac{3}{5}$–2′) broad, tapering from base to apex, crenate-serrate, rugosely-veined, green,

gray-green, tomentose, resinous-dotted beneath; flower-heads corymbed, campanulate involucre of imbricated scales, flowers 10–15, tubular, yellowish-white florets, bristly pappus; odor faintly aromatic; taste strongly bitter. Powder, dark green—multicellular non-glandular hairs, glandular hairs short-stalked, ellipsoidal pollen grains, hairs of pappus branched, tracheæ spiral, fragments of leaf epidermis with elliptical stomata; fragments of achene pericarp having cells with brownish walls; fragments of stem tissue showing epidermal cells, parenchyma, non-lignified fibers, tracheæ and pith parenchyma; numerous fragments of corolla tissue; solvents: diluted alcohol, water partially; contains eupatorin, volatile oil, resin, tannin, gum, sugar, yellow coloring matter, ash 10 p. c. Stimulant, tonic, diaphoretic (diuretic); large doses emetic, aperient, antispasmodic, similar to chamomile; intermittents, rheumatism, influenza, bronchitis. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Eupatorii* (diluted alcohol), dose, ♏xv–60 (1–4 cc.). Infusion, 5 p. c., ℥j–2 (30–60 cc.); when cold—tonic, when warm—emetic, diaphoretic. *E. purpu'reum, Gravel Root, Queen of the Meadow.* The root, U.S.P. 1820–1830; N. America, dry woods, meadows. Perennial herb, 1–2 M. (3–6°) high, stem green, purplish, purple band at joints, 2.5 Cm. (1′) broad; leaves petiolate, 3–6 in whorl, 20–25 Cm. (8–10′) long, 10–12.5 Cm. (4–5′) broad, downy beneath; flowers purple, whitish, corymbs; contains euparin; taste bitter, aromatic; astringent. *E. verbenæfo'lium* (*teucrifo'lium*), *Wild Horehound, Rough Boneset.* The herb, U.S.P. 1820–1830. Perennial hairy herb .6–2.5 M. (2–8°) high—low grounds; leaves ovate, oblong, truncate at base, toothed; flowers August, white, panicled corymb; considered by some only a variety of *E. perfoliatum*—all three possess similar properties. *E. capillifo'lium* (*fœnicula'ceum*), *Dog-fennel, Hog-weed;* Virginia-Florida. Plant smooth, 1–3 M. (3–10°) high; juice relieves pain from insect-bites.

8. *In'ula Hele'nium, Inula, Elecampane, N.F.*—The dried rhizome and roots with not more than 5 p. c. of stem-bases nor 2 p. c. of other foreign organic matter; C. and S. Europe, C. Asia. Perennial herb 1–2 M. (3–6°) high; stem thick, solid, striate, villous; leaves large, .3–.5 M. (10–18′) long, 10–20 Cm. (4–8′) broad, ovate, serrate, pubescent beneath, long-petioled, fleshy midrib; flowers large, 6 Cm. ($2\frac{2}{5}$′) broad, single, golden-yellow. Rhizome, dug in autumn of second year, usually split into longitudinal, oblique pieces having one or more roots; up to 8 Cm. (3′) long, 4 Cm. ($1\frac{3}{5}$′) thick, grayish-brown, longitudinally wrinkled with occasional buds or stem-scars, surmounted at crown by portion of over-ground stem; inner (cut) surface concave, edges incurved with the overlapping bark, yellowish-brown, striate, fibrous near cambium zone; fracture short, horny; internally light brown, with many oleoresin canals; roots cylindrical, tapering, curved, curled, up to 13 Cm. ($5\frac{1}{5}$′) long, 1.5 Cm. ($\frac{3}{5}$′) thick; odor aromatic; taste acrid, bitter, pungent. Powder, light brown—fragments of parenchyma having inulin and small separate masses of inulin; tracheæ with pores,

thickenings, occasional lignified wood-fibers and brownish fragments of walls of oleoresin canals; solvents: alcohol, water partially; contains volatile oil, acrid resin, bitter principle, inulin, helenin, wax, ash 10 p. c. Stimulant, diaphoretic, diuretic, expectorant, emmenagogue, tonic; lung diseases, bronchitis, vesical catarrh, amenorrhea, dyspepsia, skin affections, dropsy, whooping-cough, diphtheria. Dose, ʒss–1 (2–4 Gm.); 1. *Pilulæ Antiperiodicæ*, gr. ¼ (.016 Gm.); 2. *Tinctura Antiperiodica*, ⅖ p. c. Decoction, 5 p. c., ʒj–2 (30–60 cc.); Fluidextract, ʒss–1 (2–4 cc.); Infusion, 5 p. c., ʒj–2 (30–60 cc.). *I. squarro'sa;* S. Europe. Leaves tomentose, rugose, ray-florets 3-cleft, tubular; emmenagogue, diuretic; powder burned to repel insects. *Pulica'rea*

Fig. 421.—*Inula Helenium.*

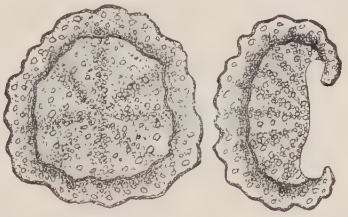


Fig. 422.—Inula: transverse section, natural size.

(*Inula*) *dysenter'ica*, *Fleawort*, and *Carli'na acau'lis*, *Carline Thistle*, *Radix Carlinæ;* Europe—both have constituents and properties similar to elecampane; diaphoretic, diuretic, large doses purgative; typhoid condition, impotence, amenorrhea, paralysis of the tongue. Dose, gr. 10–20 (.6–1.3 Gm.).

9. *Brauner'ia pal'lida*, or *B. angustifo'lia*, *Echinacea*, *Pale purple Cone-flower*, *N.F.*—The dried rhizome and roots with not more than 3 p. c. of foreign organic matter; S. United States—Kansas. Perennial herb; stem simple, naked above, single large head; leaves alternate, 3–5-nerved. Rhizome, with circular or angular pith, nearly entire; cylindrical, tapering, twisted, 10–20 Cm. (4–8′) long, 4–15 Mm. ($\frac{1}{6}$–$\frac{3}{5}$)′ thick, brownish, annulate, occasional stem-scars, wrinkled, furrowed, fracture short, fibrous; bark 1 Mm. ($\frac{1}{25}$′) thick; yellowish and black wood-wedges; odor faint, aromatic; taste sweetish, then tingling, as in aconite, but without its persistent, benumbing effect—must not be used after it has lost its characteristic odor and taste. Powder, grayish—many strongly lignified stone cells carrying characteristic carbon-like deposits, tracheæ with pores and markings, inulin-bearing parenchyma tissue with oil or resin canals filled with brownish content, cork fibers; solvent: alcohol; contains acrid resin (activity) 1 p. c., alkaloid, ash 6 p. c. Diaphoretic, sialagogue, alterative; syphilitic and strumous conditions, eczema, chronic ulcers; Sioux Indians used fresh scraped root for hydrophobia, snake-bites, septicemia. Dose, gr. 15–30 (1–2

Gm.); 1. *Fluidextractum Echinaceæ* (80 p. c. alcohol), dose, ♏xv–30 (1–2 cc.).

10. *Matrica'ria Chamomil'la, Matricaria, German Chamomile, N.F.*—The dried flower-head with not more than 5 p. c. of stems or other foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; Europe, W. Asia, cultivated in United States. Annual herb .3–.6 M. (1–2°) high, branched, smooth, solid, striate, greenish; leaves 5 Cm. (2′) long, bi-, tri-pinnate, green, smooth; leaflets linear, small. Flower-heads, May–Aug., few white ray-florets and numerous yellow disk-florets on conical hollow receptacles, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}$′) broad; disk-florets tubular, perfect, without pappus; ray-florets 10–20, pistillate, corolla white, 3-toothed, 4-veined, usually reflexed, involucre 20–30 pubescent scales; peduncles greenish, furrowed, twisted; achenes 3–5-ribbed; pappus none; odor pleasant, aromatic; taste aromatic, bitter—should be preserved in tightly-closed containers. Powder, yellowish-brown—many spinose pollen grains with 3 pores, fragments of ray-florets, glandular hairs, achene tissue with markings, parenchyma with calcium oxalate rosette aggregates, anthers, stigmas, vascular bundle with tracheæ, involucral scales bearing porous fibers, tracheæ and elliptical stomata; solvents: boiling water, alcohol; contains volatile oil .25 p. c., anthemic acid, anthemidin, tannin, ash 13 p. c.

Fig. 423.—*Matricaria Chamomilla.*

Fig. 424.—Matricaria: *a*, flower-head; *b*, involucre; *c*, receptacle and involucre; *d*, longitudinal section of receptacle, with disk-florets; *e*, ray-floret; *f*, disk-floret; *g*, stamens and style of disk-floret.

Stimulant (volatile oil), tonic (anthemic acid), carminative, diaphoretic, nervine, emmenagogue; aid to digestion in convalescence, general debility, intermittents, delirium tremens, flatulent-colic—externally: local pains, colic, toothache, earache, abscesses, sprains, rheumatism. Dose, gr.

15–60 (1–4 Gm.); 1. *Species Emollientes*, 20 p. c. Infusion, 5 p. c.; when cold—tonic, when warm—emetic, dose, *ad libitum*. Oleum Chamomillæ Infusum (flowers 10, olive oil 100, digested 2 hours)—locally. Syrup (flowers 3, water for infusion 10, sucrose 18). Poultice.

11. *Tussila'go Far'fara, Farfara, Colts-foot* (*Leaves*), *Tussilago Leaves, Cough-wort, N.F.*—The dried leaf with not more than 3 p. c. of foreign organic matter, yielding not more than 4 p. c. of acid-insoluble ash; Europe, N. Asia, naturalized in N. United States. Low succulent perennial, creeping annulate rhizome, scaly scapes in spring, bearing a single head; flowers yellow. Leaves, petioled, pubescent (young—white, floccose beneath, old—dark green above, glabrous below), orbicular, 8–15 Cm. (3–6′) long and broad, cordate, dentate, red-brown teeth, palmately 5–9-nerved, glabrous above, wrinkled, greenish; odor indistinct; taste mucilaginous, faintly herbaceous, bitter. Powder, yellowish-green—many hairs twisted together, elliptical stomata and striated epidermal cells with wavy vertical walls; few non-porous fibers and tracheæ, parenchyma cells with chloroplastids; solvents: water, diluted alcohol; contains glucoside (bitter), resin, tannin, volatile oil, gum, wax, caoutchouc, ash 20 p. c. Demulcent, toxic; bronchitis, pulmonary affections, coughs. Dose, gr. 30–60 (2–4 Gm.); 1. *Species Pectorales*, 20 p. c. Decoction, Infusion, each 5 p. c., ʒss–1 (15–30 cc.); Expressed juice; dried root, as well as leaves smoked for cough—popular domestic remedy.

12. *Ar'nica monta'na, Arnica* (*Flowers*), *Leopards-bane, N.F.*—The dried flower-head with not more than 3 p. c. of foreign organic matter; Europe—Germany, N. Asia, N. America. Perennial herb .3 M. (1°) high, hairy, striate; leaves bright green, pubescent—radical oblong-ovate, entire—cauline lanceolate; rhizome 5 Cm. (2′) long, 2–4 Mm. ($\frac{1}{12}$–$\frac{1}{6}$′) thick, brown wrinkled under surface with numerous fragile roots; achenes with hairy pappus. Flower-heads, chiefly tubular, ligulate with involucre and receptable (convex, pitted, short-hairy); ray-flowers yellow, 3-toothed, pistillate; disk-flowers tubular, perfect, reddish-yellow, stamens without tail-like appendage (dist. from *Inula Helenium*—with 2 bristles or long tails at the base); achenes fusiform, striate, glandular-pubescent, surmounted by long pappus of barbellate bristles; odor characteristic, agreeable; taste bitter, acrid. Powder, yellowish-brown—many pollen grains, 3 kinds of non-glandular hairs, 3 kinds of glandular hairs, pappus with multicellular axis and unicellular branches; solvents: diluted alcohol, hot water; contains arnicin (soluble in alcohol, alkalies) 4 p. c., volatile oil .04–.07 p. c., resin, fat, salt, arnidol (phytosterol), ash 6–9 p. c. Stimulant, tonic, carminative, diuretic, irritant, sternutatory, vulnerary—slows the heart, increases arterial tension; large doses (poisonous) emetic, cathartic, causing abdominal pains, headache, increased pulse and respiration, finally dilated pupils, muscular spasms (rare), cold extremities, infrequent pulse, death—resembling aconite—best antidote: atropine; typhoid condition, brain concussion, intermittents, diarrhea, gout, nephritis,

rheumatism, dropsy, chronic catarrh, nervous affections—locally: paralysis, sprains, bruises, abrasions. Dose, gr. 5–20 (.3–1.3 Gm.); 1. *Fluidextractum Arnicæ* (67 p. c. alcohol), dose, ♏v–10 (.3–.6 cc.). 2. *Tinctura Arnicæ*, 20 p. c. (diluted alcohol), dose, ♏xv–45 (1–3 cc.).

FIG. 425.—*Arnica montana: 1*, rhizome and stem; *2*, flowering stem; *3*, vertical section of disk-flower; *4*, ray-floret.

Infusion, 5 p. c., ℥ss–1 (15–30 cc.). Fomentation. Rhizome—Decoction. Extract—Plaster; Fluidextract, Tincture, all having same strength and doses as those from flower-heads. *A. folio'sa*, *A. alpi'na*, and *A. Chamisso'nis*, California to Maine, produce closely resembling flower-heads.

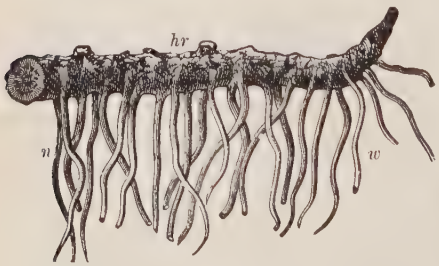


FIG. 426.—*Arnica montana: hr*, rhizome; *n-w*, roots.

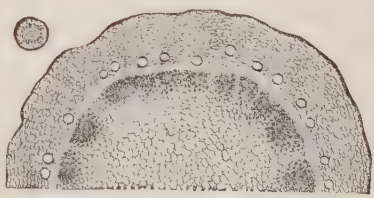


FIG. 427.—Arnica: transverse section of rhizome, natural size, and magnified 12 diam.

13. *Senec'io au'reus*, *Senecio*, *Life Root Plant*, *Ragwort*, *Squaw-weed*, *N.F.*—The dried plant with not more than 10 p. c. of foreign organic matter; Eastern N. America. Perennial herb .3–.6 M. (1–2°) high,

nearly smooth, fluted, sparingly clothed with small leaves, also a basal rosette, and several yellow heads (corymb) at summit, white floccose when young, then glabrous; radical leaves petiolate, rounded, 5–7 Cm. (2–3′) broad, crenate-dentate, cordate; stem-leaves lyrately pinnate, then pinnatifid, sessile; heads slender, 12–25 Mm. (½–1′) broad, involucral scales in 2 series closely appressed; rays 10, bright yellow, disk flowers many, small, bearing a glabrous achene, white pappus; odor characteristically aromatic; taste bitter, astringent, acrid, pungent. Powder, dark green—many twisted non-glandular hairs with thin walls and oily content; leaf tissue composed of chlorenchyma, epidermal cells, elliptical stomata; solvent: diluted alcohol; contains volatile oil, resin, bitter principle (senecin), tannin, ash 10 p. c. Stimulant, diuretic, emmenagogue, vulnerary; atonic conditions, amenorrhea, dysmenorrhea; popular with "Eclectics," Homeopaths, and American Indians. Dose, ʒss–1 (2–4 Gm.); 1. *Fluidextractum Senecionis* (67 p. c. alcohol), dose, ʒss–1 (2–4 cc.). Decoction, Infusion, each 5 p. c., ʒj–2 (30–60cc.).

14. *Calen'dula officina'lis, Calendula, Marigold, N.F.*—The dried ligulate-florets with not more than 2 p. c. of foreign organic matter; S. Europe, Levant, cultivated as ornament (flowers). Annual herb .3–.6 M. (1–2°) high, roughish-hairy; leaves toothed, oblanceolate; flower-heads terminal, 5 Cm. (2′) broad, involucre hemispherical, 2-rowed; disk-florets tubular, 5-cleft, yellow. Ligulate (ray) florets 15–25 Mm. (⅗–1′) long, 3–6 Mm. (⅛–¼′) broad, yellowish, 1–3-toothed, short-hairy tube occasionally enclosing remnant of filiform style and bifid stigma; odor slight, somewhat heavy; taste slightly bitter, faintly saline. Powder, yellowish—few non-glandular hairs, double row of thin-walled cells; elongated epidermal wavy-walled cells with chromoplasts and oil-like globules; pollen grains with spinose projections, 3-pored; tracheæ: calcium oxalate rosettes or prisms; solvents: alcohol, boiling water partially; contains volatile oil, bitter principle, calendulin (analagous to bassorin), fat, resin, sugar, gum, ash 8–11 p. c. Stimulant, tonic, febrifuge, anthelmintic, resolvent; jaundice, amenorrhea, scrofula, low fevers, vomiting; cancer, ulcers, wounds, otitis—Homeopathic remedy instead of tincture of arnica or myrrh. Dose, gr. 15–60 (1–4 Gm.); 1. *Fluidextractum Calendulæ* (67 p. c. alcohol), dose, ♏xv–60 (1–4 cc.); 2. *Tinctura Calendulæ*, 20 p. c. (alcohol), dose, ʒss–2 (2–8 cc.).

15. *Arc'tium Lap'pa, Lappa, Burdock Root, Clotbur, N.F.*—The dried first year root with not more than 5 p. c. of leaf-bases nor 2 p. c. of other foreign organic matter; Europe, N. Asia, naturalized in N. America—rich waste places. Coarse biennial weed .6–2 M. (2–6°) high, branched; leaves cordate-oblong, dentate, rough, petiolate; flowers purple, calyx of imbricated scales with hooked extremities for adhering to objects; achenes (burs) 12–25 Mm. (½–1′) broad, globoidal, 3-angled; seed quadrangular; *A. mi'nus*, heads small, involucre at first cottony, finally smooth; leaves unequally rounded at base. Root .25–.8 M. (10–30′) long, 5–20 Mm. (⅕–⅘′) thick, nearly simple, fusiform, fre-

quently split or broken, grayish-brown, longitudinally wrinkled, crown annulate, sometimes surmounted by woolly tuft of leaf remains; fracture somewhat horny; dark cambium separating thick brownish bark from yellowish, porous radiate wood, centrally hollow or with white pith-like tissue; odor slight, pyroligneous on milling; taste mucilaginous, sweetish, slightly bitter. Powder, light brown—parenchyma cells of cortex, medullary ray cells and wood parenchyma of young roots; few wood-fibers, no starch or calcium oxalate; solvents: diluted alcohol, boiling water partially; contains inulin, bitter extractive, resin, fat 9 p. c., mucilage, sugar, wax, tannin (phlobaphene), lappin, ash 6 p. c. Diaphoretic, diuretic, alterative, aperient, depurative; rheumatism, gout, pulmonary catarrh, psoriasis, acne, syphilis, scrofula, urinary deposits, burns, wounds, eruptions, swellings. Dose, ʒss–2 (2–8 Gm.); 1. *Fluidextractum Lappæ* (diluted alcohol), dose,

FIG. 428.—*Arctium Lappa.*

FIG. 429.—Lappa: transverse section, magnified 2 diam.

ʒss–2 (2–8 cc.). Tincture, **10 p. c.** (diluted alcohol, whisky), dose, ʒij–3 (8–12 cc.), after meals. *Fructus Lappæ, Semen Bardanæ,* U.S.P. 1830; the seed about 6 Mm. (¼′) long, obovate-oblong, slightly curved, angular, flattened, roughish, brown-gray, mottled with black; inodorous taste oily, bitter; contains drying oil 15.4 p. c., resins 5.5 p. c., lappin; tincture 25 p. c. (75 p. c. alcohol), ʒss–2 (2–8 cc.); fluidextract, ♏xv–30 (1–2 cc.—tonic); ʒss–1 (2–4 cc.—alterative). *Fructus Silybi* (*Sil′ybum Maria′num*), *Mary Thistle;* S. Europe; achenes 5 Mm. (⅕′) long, not curved, obovate, flattened, smooth, glossy, light brown, with blackish striæ, brownish; taste oily, bitter. *Bi′dens bipinna′ta, Spanish Needles, Beggar-lice;* stem square, achenes triangular, barbed; stimulant, aromatic (vol. oil), antispasmodic, expectorant, diaphoretic; hay fever, amenorrhea (hot infusion), asthma, bronchitis. *Rudbeck′ia hir′ta, Yellow Daisy, Black-eyed Susan, Nigger-head;* stimulating diuretic ("Eclectic's").

16. *Xan'thium Struma'rium, Broad Cocklebur;* N. America. Achenes 2.5 Cm. (1′) long, flat, oblong, without pappus, enclosed in the involucre, which is densely beset with hooked prickles. *X. spino'sum, Spiny* or *Thorny Clotbur;* N. America, S. Europe; leaves with spines at base 2.5 Cm. (1′) long; fertile axillary burs (achenes) crowned with 1 inconspicuous beak. *X. canaden'se,* and its var. *echina'tum;* achenes, with 2 stout beaks, hooked, 2.5 Cm. (1′) long, densely prickly, hispid; river banks, waste places; var. *echinatum,* smaller plant—possibly unworthy of variety distinction.

17. *Solida'go odo'ra, Sweet* or *Anise-scented Golden-rod.*—The leaves and tops, U.S.P. 1820–1870; N. America. Perennial herb, .6–1 M. (2–3°) high, greenish-yellow, pubescent; leaves lanceolate, pellucid-dotted, 2.5–5 Cm. (1–2′) long, 12 Mm. (½′) wide; flowers yellow, racemes; fruit achenes; odor and taste sweet, anise-like, more pronounced when bruised; contains volatile oil. Stimulant, rubefacient, anodyne, carminative, diaphoretic, aromatic; hemorrhages, colic, neuralgia, amenorrhea, rheumatism; infusion, oil. Dose, ʒss–2 (2–8 Gm.); oil, ♏j–5 (.06–.3 cc.).

18. *Erig'eron canaden'sis, Canada Fleabane, Horseweed, Fireweed.*—The herb, U.S.P. 1820–1870; the volatile oil distilled from the fresh flowering herb, U.S.P. 1860–1900; N. America, fields, waste places; naturalized in other countries. Annual herb, .3–2.5 M. (1–8°) high; stem branching, hairy, furrowed; leaves linear-lanceolate, entire, dentate; flowers small, numerous, white, terminal panicles; contains volatile oil .2–.4 p. c., bitter principle (amaroid), tannin, gallic acid. Oil is a pale yellow liquid, darker and thicker with age and exposure; odor peculiar, aromatic, persistent; taste aromatic, pungent, sp. gr. 0.850; contains *d*-limonene, $C_{10}H_{16}$, terpinol, a substance easily decomposed or polymerized by heat making distillation difficult at ordinary pressure. *Test:* 1. Soluble in equal volume of alcohol (dist. from oil of fireweed, *Erechthi'tes hieracifo'lia,* and oil of turpentine), also in equal volume of glacial acetic acid, which solution with bromine yields crystals of $C_{10}H_{16}Br_4$. Stimulant, tonic, diuretic, diaphoretic, styptic; diarrhea, dysentery, gravel, dropsy, hemorrhages of uterus and bowels; similar to oil of turpentine, but less irritating and stimulating. First employed by the "Eclectics." Should be kept cool, dark, in well-stoppered, amber-colored bottles. Dose, gr. 15–60 (1–4 Gm.); decoction, 5 p. c., ʒss–1 (15–30 cc.); oil, ♏v–10 (.3–.6 cc.). *E. an'nuus (heterophyl'lus), Various-leaved Fleabane, Sweet Scabious;* the herb, U.S.P. 1830–1860. Biennial herb, 1–1.5 M. (3–5°) high, branched, hairy, leaves sharply, coarsely toothed; flowers Aug., corymbs, rays white tinged with purple, disk yellow; in fields, waste places. *E. philadel'phicus, Philadelphia Fleabane;* the herb, U.S.P. 1820–1850. Perennial herb, .3–1 M. (1–3°) high, pubescent, slender, leafy; leaves 5–10 Cm. (2–4′) long, 12–18 Mm. (½–¾′) wide, midrib broad, flowers June-Aug., numerous, panicled corymbs, rays 150–200, filiform purplish, disk yellow. Both have same constituents and properties as *E. canadensis.*

COMPOSITÆ

19. *Achille'a Millefo'lium, Yarrow, Milfoil.*—The leaves and flowering tops, U.S.P. 1860–1870; N. America. Perennial herb, .3–.6 M. (1–2°) high, hairy; leaves lanceolate, glandular beneath, 5–25 Cm. (2–10′) long, twice pinnatifid, segments toothed; flowers Aug., corymbs, receptacle flat, chaffy, ray-florets white, pistillate; disk white, perfect; fruit achenes, chamomile odor, taste bitter, aromatic; contains volatile oil, achilleine, resin, tannin. Stimulant, tonic, emmenagogue; amenorrhea, menorrhagia, piles, leucorrhea, colic, relaxed throat, sore nipples, intermittents; infusion, expressed juice. Dose, ʒss–1 (2–4 Gm.); oil, ♏v–15 (.3–1 cc.).

Fig. 430.—*Achillea Millefolium.*

20. *An'themis no'bilis, Roman Chamomile.*—The dried flower-heads of cultivated plants, U.S.P. 1820–1900; S. and W. Europe. Perennial herb, 15–30 Cm. (6–12′) high, hairy; leaves bipinnatisect, hairy. Flowers, 18 Mm. (¾′) broad, subglobular, consisting of imbricated involucre, many white, 3-toothed ray-florets and a few tubular disk-florets inserted upon chaffy, conical, solid receptacle; odor agreeable; taste aromatic, bitter; solvents: alcohol, hot water; contains volatile oil 1 p. c., anthemic acid (bitter principle), anthemene (anthemidin),

Fig. 431.—*Anthemis nobilis:* wild.

a *b*

Fig. 432.—Anthemis: *a*, ray- and disk-floret, magnified 4 diam.; *b*, section through single flower-head, natural size.

resin 5.25 p. c., tannin, fixed oil. Stimulant (volatile oil), tonic (anthemic acid), carminative, nervine emmenagogue; warm infusion—emetic; cold infusion—tonic; large doses emetic, cathartic; intermit-

tents, torpid liver, delirium tremens, dyspepsia (masticatory); externally—colic, toothache, earache, rheumatism, ulcers, sprains (poultice with vinegar, laudanum); oil—rheumatism, flatulent colic. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ʒss–1 (2–4 cc.); infusion (best form), 5 p. c., ʒj–2 (30–60 cc.); oil, ♏j–5 (.06–.3 cc.). *A.* (*Maru'ta*) *Cot'ula, Mayweed;* the herb, U.S.P. 1820–1870; N. America. Annual plant in fields, roadsides, .3–.6 M. (1–2°) high, greenish, furrowed, leaves thrice pinnatifid; flowers, June-Sept., receptacle solid, conical, chaffy, ray-florets white, disk yellow; contains volatile oil, valeric acid, fat, tannin, anthemidine (?), anthemic acid. Stimulant, antispasmodic, sudorific, emmenagogue, vesicant for hysteria, colic, dysmenorrhea; in infusion. Dose, ʒss–2 (2–8 Gm.).

Fig. 433.—*Anacyclus Pyrethrum: A*, expanded flower; *B*, involucre seen from below; *C*, dried flower.

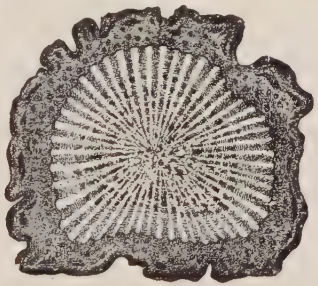


Fig. 434.—Pyrethrum: transverse section magnified 3 diam.

21. *Anacy'clus Pyre'thrum, Pyrethrum, Pellitory* (*Root*).—The dried root, U.S.P. 1820–1910; N. Africa, Algeria—high lands, cultivated in gardens. Procumbent perennial, resembling chamomile, .3 M. (1°) high, with 1 large terminal flower; leaves doubly pinnate, pale green; flowers, April-June, 2.5–4 Cm. (1–1$\frac{3}{5}$′) broad, rays white above, reddish-purple below, disk yellow; fruit obovate achene. Root, tapering, in pieces 2.5–10 Cm. (1–4′) long, 5–20 Mm. ($\frac{1}{5}$–$\frac{4}{5}$′) thick, dark brown, furrowed, wrinkled; fracture short; bark with 1–2 circles of resin ducts, closely adhering to yellowish radiate porous wood in which occur 1–3 rows of resin ducts; odor distinct; taste sweetish, pungent, very acrid, tingling, sialagogue effect. Powder, brownish—masses of inulin, fragments of woody tissue, stone cells, cork, tracheæ, parenchyma; should be kept in tightly closed containers; solvents: alcohol, boiling water partially; contains pyrethrine (activity), brown acrid resin (containing pellitorin), 2 potassa-soluble acrid fixed oils, inulin 50 p. c., tannin, volatile oil, gum, ash 3–5 p. c. Irritant, rubefacient, sialagogue (prickling sensation to tongue and fauces with heat, pun-

gency), sternutatory—poisonous; masticatory—headache, rheumatism, neuralgia, toothache (tincture or extract as an anesthetic in carious teeth), paralysis of tongue or throat, relaxed uvula, chronic catarrh. Dose, ʒss–1 (2–4 Gm.). Tincture, 20 p. c., ʒss–2 (2–8 cc.); Fluidextract, ʒss–1 (2–4 cc.); Decoction, Extract (alcohol), Gargle. *A. officina'rum, German Pellitory*—annual variety, cultivated in Saxony, Bohemia, Prussia, near Magdeburg, having root 6 Mm. (¼′) thick; bark with 1 circle of resin-cells, medullary rays without resin-cells.

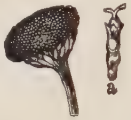


Fig. 435.—*Tanacetum vulgare:* flower; *a*, single flower.

22. *Tanace'tum vulga're, Tanacetum, Tansy.*—The leaves and tops, U.S.P. 1820–1890; Europe, Asia. Perennial herb, .6–1 M. (2–3°) high; stem obscurely hexagonal, striated, often reddish; root fibrous, many-headed; flowers yellowish discoid, dense, terminal corymbs; fruit achene, small, oblong, 5–6 ribs, crowned with pappus. Leaves, 15 Cm. (6′) long, bipinnatifid, segments obtuse, oblong, serrate, glandular, receptacle convex, naked, florets tubular; odor strong, aromatic;

Fig. 436.—*Carthamus tinctorius.*

taste pungent, bitter; contains volatile oil .25 p. c., tanacetin, fat, resin, tannin, mucilage; solvents: alcohol, water. Stimulant, tonic, emmenagogue, anthelmintic, diuretic, narcotic; large doses cause vomiting, convulsions, coma, mydriasis, feeble respiration and pulse, death from paralytic asphyxia. Used in intermittents, hysteria, amenorrhea, colic, abortifacient; locally for bruises, sprains, rheumatism, ulcers. Dose, gr. 15–60 (1–4 Gm.); fluidextract, ♏xv–60 (1–4 cc.);

infusion, 5 p. c., ʒj–2 (30–60 cc.); oil ,mj–5 (.06–.3 cc.). *T. vulgare* var. *cris'pum, Double Tansy.*—Leaves twice pinnatifid, curled. *T. Balsam'ita* (*Pyrethrum Tanacetum*), S. Europe; odor strong, taste bitter. Both often cultivated and used similar to *T. vulgare.*

23. *Car'thamus tincto'rius, Safflower.*—The dried florets, U.S.P. 1820–1870, India, cultivated, in America, etc. Annual herb, .3–.6 M. (1–2°) high, branched; leaves spinose; flowers orange-red, corolla tubular, 2.5 Cm. (1′) long, 5-lobed; odor slight, taste bitter; contains volatile oil, carthamin (red) .5 p. c., saffron yellow 24–30 p. c. Diaphoretic (hot infusion), tonic, laxative; measles, scarlatina (to promote eruption), catarrh, rheumatism; in infusion. Dose, gr. 5–15 (.3–1 Gm.).

24. *Gnapha'lium obtusifo'lium* (*polyceph'alum*), *Common, Sweet,* or *Fragrant Life Everlasting.*—Annual erect herb, .3–1 M. (1–3°) high, woolly, fragrant; leaves lanceolate, undulate, sessile, flowers in heads, clustered at summit of corymbose branches, obovate, whitish involucre, yellow, tubular, odor pleasant, bitter; contains volatile oil and bitter principle. Used for diarrhea, hemorrhages, externally in fomentation and as a vulnerary to bruises, ulcers, etc. Dose, ʒss–1 (2–4 Gm.).

25. *Chrysan'themum* (*Pyrethrum*) *ro'seum* and *C. car'neum, Persian Pellitory—Persian* (*Caucasian*) *Insect Powder;* W. Asia, Persia. Perennial plants, resembling chamomile; flower-heads 4 Cm. ($1\frac{3}{5}$′) broad; ray-florets rose-color with anthers included (*roseum*), or purple with anthers projecting (*carneum*); powder grayish-yellow, brownish (best), bright yellow (weakest), tea odor, bitter—used only for killing insects, the toxicity being due to pyrethron (pyrethrotoxic acid—cardiac depressant like veratrine), a neutral, amber-yellow syrupy ester (pyretol) soluble in alcohol, ether, splitting into pyrethrol, $C_{21}H_{34}O$, and several acids, pyrethresin.

26. *C. cinerariæfo'lium, Dalmatian Insect Powder;* Dalmatia. These flowers are most valuable when collected immediately after expansion, and yield a more or less inferior insect powder—geeenish-yellow. Plant cultivated in Algeria, Japan, Montenegro, and largely in California, where flowers are dried carefully (to preserve color and volatile oil)—furnishing a superior powder, called "buhach." Should not contain more than 5 p. c. flower-stems or 2 p. c. acid-insoluble ash. *Tests:* 1. Put 4 gr. (.25 Gm.) of the powder upon a fly in a vial—it should be stupefied in 1 minute and dead in 2 or 3 minutes. 2. With microscope can recognize scarcity of pollen and abundance of collenchymatous tissue when much stem and few flowers are used. Powder often adulterated with turmeric (chloroform test), chrome alum (ash not more than 6 p. c.), and other compositous plant flowers, as *Chrysanthemum Leucan'themum* (*Leucanthemum vulga're*), white-weed, oxeye or field daisy, and *C. seg'etum.* Neither of these is an insecticide, but will produce dermatitis in some persons.

RECAPITULATION TABLE No. 6—U.S.P. DRUGS AND PREPARATIONS.

Family (Nat. order). 1. Latin official name. 2. Eng. official name.	Botanic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Solanaceæ:								Grains.
1. Capsicum. 2. Capsicum.	Capsicum frutescens.	The dried ripe fruit.	S. and C. America.	Capsaicin, fixed oil, volatile oil, resin, capsicine.	Oleoresin, plaster, tincture.	Stimulant, stomachic, diaphoretic, rubefacient.	Dyspepsia, colic, cholera, diphtheria, menorrhagia, rheumatism, relaxed uvula.	1-5 (.06-.3 Gm.).
1. Belladonnæ Folia. 2. Belladonna Leaves.	Atropa Belladonna.	The dried leaves and tops.	C. and S. Europe.	Atropine, belladonnine, hyoscyamine, scopolamine, atropamine, atrosin, malic acid, starch; homatropine.	Extract (pil., pow.), plaster, ointment, fldext., tinct.	Sedative, narcotic, mydriatic, antispasmodic, anodyne.	Rheumatism, neuralgia, sciatica, cancer, meningitis, erysipelas, asthma, coughs, spasms, scarlet fever, abscesses, eczema, phthisis.	½-3 (.03-.2 Gm.).
1. Belladonnæ Radix. 2. Belladonna Root.	.....	The dried root.	.....	.....	Fluidextract, atropine, atrop. sulph.	.....	.....	½-2 (.03-.13Gm.).
1. Hyoscyamus. 2. Hyoscyamus.	Hyoscyamus niger.	The dried leaves (leaf), with or without tops.	Europe, Asia.	Hyoscyamine, scopolamine (hyoscine), choline, hyoscipicrin, KNO_3.	Extract, fluidextr., tincture, hyoscyamine hydrobrom., scopolamine hydrobrom.	Anodyne, hypnotic, narcotic, mydriatic, laxative, carminative.	Mania, insomnia, insanity, coughs, colics, paralytic tremors, bladder trouble, constipation, chorea, tetanus.	2-10 (.13-.6 Gm.).
1. Stramonium. 2. Stramonium.	Datura Stramonium.	The dried leaves and flowering tops.	Asia, nat. universally.	Daturine, vol. oil, mucilage, albumin, KNO_3.	Extract (pil., pow.), tincture.	Narcotic, anodyne, antispasmodic, diuretic, mydriatic.	Insanity, epilepsy, asthma, whooping-cough, rheumat., dysmenorr., chorea, sprains, ulcers, hemorrhoids.	1-5 (.06-.3 Gm.).
Scrophulariaceæ:								
1. Digitalis. 2. Digitalis.	Digitalis purpurea.	The dried leaves (leaf).	W. and C. Europe.	Digitoxin, digitophyllin, gitalin, gitin, digitonin, digitsaponin, enzymes; vol. oil, digitalin.	Infusion, tinct.	Cardiac tonic, vascular stimulant, sedative, narcotic, diuretic, emetic.	Feeble heart, renal dropsy, pneumon., mania, delirium, menorrhag., epilep., enlarged glands.	1-2 (.06-.13Gm.).
Rubiaceæ:								
1. Cinchona. 2. Cinchona.	Cinchona: succirubra, Ledgeriana, Calisaya.	The bark.	S. America, (Java, India, Ceylon).	Quinine, quinidine, cinchonine, cinchonidine, quinamine, chinoidine, quinic, quinovic, cinchotan. acids, cinchona-red, vol. oil, resin.	Fluidext., tinct., tinct. cinch. co., alkaloids and salts.	Tonic, antiperiodic, antispasmodic, febrifuge, astringent.	Dyspepsia, convalescence, gastritis, asthma, bronchitis, intermitts., typhoid pneumon., neuralgia, erysipelas.	15-60 (1-4 Gm.).

1. Gambir. 2. Gambir.	Ourouparia Gambir.	Dried aqueous extract of leaves, twigs.	E. India Islands.	Tannic acid, catechin.	Tinct. co.	Astringent, tonic.	Diarrhea, leucorrh., phthisis, bronchitis, relaxed uvula, dyeing.	5–30 (.3–2 Gm.).
1. Caffeina. 2. Caffeine. 1. Thea. 2. Tea.	Coffea arabica. Thea sinensis.	Feeble basic substance (alkaloid) from seeds (1), leaves (2).	Trop. Africa. S. E. Asia.	$C_8H_{10}O_2N_4.H_2O$.	Citrat. caffeine, caf. sod. benz.	Tonic, stimulant, nervine, antiemetic, diuretic.	Nervous headache, diarrhea, phthisis, dropsy, gout, insomnia, fevers.	Caffeine 1–5 (.06–.3 Gm.).
1. Ipecacuanha. 2. Ipecac.	Cephaëlis: Ipecacuanha, acuminata.	The dried rhizome and roots.	Brazil, Bolivia, Columbia.	Emetine, cephaëline, psychotrine, emetroidine (kryptonine), ipecamine, ipecacuanhic acid, resin.	Fluidext., syr., pulv. ip. et opii.	Emetic, expectorant, diaphoretic, cholagogue, hemostatic.	Catarrh, croup, asthma, pneumon., dyspep., vomit. of preg., cholera, ophthalmia.	1–20 (.06–1.3 Gm.).
Valerianaceæ: 1. Valeriana. 2. Valerian.	Valeriana officinalis.	Dried rhizome and roots.	Europe, N. Asia.	Vol. oil, valeric, formic, acetic, malic acids, chatinine, tannin, resin.	Tincture, am. tincture.	Stimulant, anodyne, nervine, antispasmodic, vermifuge.	Hysteria, nervous coughs, diabetes, delirium tre., typhoid, dysmenorrhea, epilepsy.	15–60 (1–4 Gm.).
Cucurbitaceæ: 1. Elaterinum. 2. Elaterin.	Ecballium Elaterium.	A substance from juice of fruit.	W. Asia, N. Africa, S. Europe.	$C_{20}H_{28}O_5$.	.....	Hydragogue cathartic.	Dropsy, brain and lung congestion, uremia.	$\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).
1. Colocynthis. 2. Colocynth.	Citrullus Colocynthis.	Dried pulp of unripe fully grown fruit.	Asia, Africa, S. Europe.	Colocynthin, colocynthitin, pectin, gum.	Extract, comp. extr., pil. hg. chlor. mit. co.	Cathartic, drastic, diuretic, emetic.	Evacuant, dropsy, apoplexy, paralysis.	2–10 (.13–.6 Gm.).
1. Pepo. 2. Pepo.	Cucurbita Pepo.	The dried ripe seed.	Tropical Asia, America.	Fixed oil, resin, starch, proteins.	.....	Tenifuge, vermifuge.	Tape and lumbricoid worms.	480–960 (30–60 Gm.).
Campanulaceæ: 1. Lobelia. 2. Lobelia.	Lobelia inflata.	The dried leaves and tops.	N. America.	Lobeline, inflatin, lobelacrin, lobelic acid, resin, vol. oil.	Tincture.	Expectorant, emetic, nervine, purg., narcotic.	Spasmod. asth., catarrh, bronch. spasms, whooping-cough.	1–20 (.06–1.3 Gm.).
Compositæ: 1. Santoninum. 2. Santonin.	Artemisia pauciflora.	The inner anhydride of santonic acid from flowers.	N. Turkestan.	$C_{15}H_{18}O_3$.	.....	Anthelmintic, stimulant, emmenagogue.	Round and thread worms, incontinence of urine; eye affections.	$\frac{1}{4}$–4 (.016–.26 Gm.).

PART II.

ORGANIC DRUGS FROM THE ANIMAL KINGDOM.

The Animal Kingdom is divided into two great subkingdoms, viz.:

I. Invertebra'ta. L. fr. *in*, not, + *vertebratus*, vertebrated—*i. e.*, not vertebrated. These have no vertebra, backbone, or spinal column.

II. Vertebra'ta. L. fr. *vertebratus*, jointed, articulated—*i. e.*, vertebrated. These have a backbone (spinal bone) surrounding, and thus protecting, the spinal cord, often called conjointly spinal column.

Subkingdom I. **INVERTEBRATA.**

Class 1.: **INSECTA.** L. pl. of *insectum*. This class includes those small animals that have 1 pair of antennæ, 3 pairs of mouth organs, and breathe air by means of tracheæ, opening by spiracles along the sides of the body, as hexapods (6-legged) and myriapods (many-legged).

1. HEMIPTERA. Hemipterous Order (Family).

He-mip'te-ra. L. neut. pl. of *hemipterus*, half-winged, fr. Gr. ἡμι, half, + πτερόν, wing—*i. e.*, insects have forewings partly membranous and partly coriaceous, chitinous. This order (family) includes the various kinds of bugs—hexapod insects, having a jointed proboscis, including 4 sharp stylets (mandibles and maxillæ) for piercing and sucking; have no sucking stomach. They feed upon plant-juices or animal blood. The metamorphosis is mostly incomplete; the molt is, as a rule, repeated 4 times, the stage next to the last, preceding the imago, being called pupa. Includes squash-bug, soldier-bug, bed-bug, cicidas, cuckoo, spites, plant lice, scale insects, thrips, lice.

Genus: **1. Coccus.**

COCCUS. COCHINEAL, *U.S.P.*

Coccus cacti, *Linné.* } The dried female insects enclosing the young larvæ.

Habitat. Mexico, C. America; cultivated in W. Indies, Canaries, Algiers, S. Spain.
Syn. Cochineal Insect; Fr. Cochenille; Ger. Coccionella, Scharlachwurm.
Coc'cus. L. fr. Gr. κόκκος, a grain, berry, kernel—*i. e.*, from the insect resemblance.
Cac'ti. L. gen. of *cactus*, fr. Gr. κάκτος, a prickly plant—*i. e.*, insects feed upon Cactus species.
Coch'i-ne-al. L. fr. *cochinilla*, L. *coccineus*, scarlet, *coccum*, a berry—*i. e.*, which the kermes insect resembles, and was once supposed to be.

HEMIPTERA

INSECT.—The female when full-grown is 8 Mm. ($\frac{1}{3}'$) long, 6 Mm. ($\frac{1}{4}'$) high, when dry 3.5–5 Mm. ($\frac{1}{7}$–$\frac{1}{5}'$) long, somewhat ovate, convex above, concave beneath, consisting of 9–12 segments, grayish-purple, grayish; numerous larvæ, less than 1 Mm. ($\frac{1}{25}'$) broad, in the shell-like, horny abdomen; mature larvæ with 8-jointed antennæ, 3 pairs of legs, the lower having 6-8 segments and a characteristic beak (rostrum) of 4 thread-like parts which pair off into 2 coils; easily pulverizable into dark red powder; odor characteristic; taste slightly bitter; masticated—colors saliva red; macerated in water—no insoluble powder separates; red color of dilute aqueous solutions + acids—light orange; + alkalies—purple. Dose, gr. 1–15 (.06–1 Gm.).

ADULTERATIONS.—I. SILVER-GRAIN: Barium and lead carbonates or sulphates, talcum, etc. II. BLACK-GRAIN: Graphite, ivory black, manganese dioxide. III. FACTITIOUS: Artificial product made of starch, gum, mineral and coloring matters; also prepared by coloring exhausted cochineal powder with rosaniline, and granulating; recognized by readily forming paste with water. *Tests:* 1. Macerate in water, when the powder separates, the minerals depositing; or burn insects and note the increased ash yield—

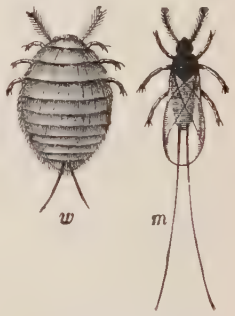


FIG. 438. — Cochineal insects, magnified 3 diam.: *w*, female; *m*, male.

FIG. 437.—*Coccus cacti*, female insect, natural size: *a*, before, and *b*, *c*, after impregnation, dry, and soaked in water.

12–35 p. c. 2. Cold decoction is decolorized by potassium permanganate, preferably in the presence of a little indigo carmine.

Commercial.—Female is official, being twice the size of the male, with a rostrum and bluish-red body, underside flat, upper convex, but without wings and bristles, both of which the male possesses. They feed upon Cactus species, especially *Nopa'lea cochinillif'era* (*Opun'tia coccinellif'era*), to which the females attach themselves and remain continuously at one point, copulating and growing rapidly, until the several thousand eggs are hatched by the sun within the body after death—the body being concealed by a white wax, in the form of a fluffy cotton-like mass. In Mexico, during the rainy seasons, insects are kept on cactus branches under roof, and in good weather are *sown* upon plants without, the young ones being allowed to develop until females become fecundated and enlarged, when they are brushed from the branches into hot water and killed, thereby removing the wax and requiring further drying by sun or fire, producing *black-grain cochineal;* if they are killed by exposure to sulphur fumes and dried by sun or ovens the wax is retained, producing *silver-grain cochineal.*

The wild-grown (*granilla*, "little grain," *grana sylvestra*, "wild grain") and the older insects are inferior in the yield of coloring matter. In cultivation some females always are left for propagation (100–200 to each male), which usually produce 3 crops before the return of the rainy season. Aqueous infusion or decoction violet-crimson, brightened by acids, deepened (purplish) by alkalies; upon adding zinc, bismuth, or nickle salts—lilac precipitate; iron salts—dark purple, black; tin salts (nitrate, chloride)—brilliant scarlet; alumina—pigment called *lake;* acids, animal gelatin, (salts of tin), alum, cream of tartar, salt of sorrel—pigment called *carmine.*

Constituents.—Carminic acid, $C_{17}H_{18}O_{10}$, 10 p. c., Coccerin (wax), $C_{30}H_{60}(C_{31}H_{61}O_3)_2$, 1–2 p. c., fixed oil (oleic, linoleic, myristic acids), 4–6 p. c., myristin 1.5–2 p. c., fats, gum, volatile oil, ash 3–6 p. c.

Carminic Acid.—This is the coloring matter, being obtained by macerating in ether, treating residue successively with boiling alcohol, from which it deposits upon cooling and spontaneous evaporation; it is brownish-purple, yielding red powder, soluble in water, alcohol, alkalies—which change color of solutions to purple, acids to reddish-yellow, slightly soluble in ether, insoluble in fixed and volatile oils. When boiled with diluted sulphuric acid splits into sugar and carmine-red, $C_{11}H_{12}O_7$, a vermilion-red powder, soluble in water, alcohol, and alkalies.

Preparations.—1. *Tinctura Cardamomi Composita,* ½ p. c. 2. *Liquor Cocci, N.F.,* 6.5 p. c.—cochineal 6.5 Gm., pot. bitart. 6.5, pot. carb. and alum, āā 3.2, glycerin 45 cc., water q. s. 100 cc. 3. *Syrupus Asari Compositus, N.F.,* .15 p. c.

Unoff. Preps.: Infusion (*Infusum Cocci*), ʒss–1 (15–30 cc.). *Tinctura Cocci* (Br.), 10 p. c. (45 p. c. alcohol), ♏v–30 (.3–2 cc.).

Properties.—Stimulant, antispasmodic, diuretic.

Uses.—Whooping-cough, neuralgia, chiefly for its coloring properties, especially carmine; in tinctures; tooth powders, etc.

Derivative Product:

1. *Carminum, Carmine, N.F.*—The aluminum lake of the coloring principle obtained from cochineal. Occurs in irregular, angular, bright red fragments or powder; odorless, tasteless; when burned—emits odor of burned feathers; soluble in ammonia water or alkaline liquids—dark purplish-red solutions, slightly soluble in water—imparting red color; incinerate—ash 10–12 p. c. *Test:* 1. Fuse ash from 1 Gm. with sodium cyanide 1 Gm., dissolve mass in hydrochloric acid + few drops nitric acid, add distilled water q. s. 30 cc.—filtered portions of 10 cc. yield no precipitate with hydrogen sulphide T. S. or sulphuric acid (abs. of tin, lead, soluble barium compounds); contains carminic acid 50–60 p. c. *Impurities:* Tin, lead, barium sulphate, soluble barium compounds—vermilion, lead dichromate, starch, sometimes 60–70 p. c. Should be kept in well-stoppered, amber-colored bottles. Used as a coloring agent; 1. *Liquor Carmini,* 6.5 p. c.—carmine 6.5 Gm., ammonia water and glycerin, āā 36.5 p. c., water q. s. 100 cc. 2. *Tabellæ Hydrargyri Chloridi Mitis,* $\frac{1}{120}$ gr.

HEMIPTERA

Allied Insects:

1. *Coccus ili'cis.*—Greece (Morea, mountains); inhabits *Quercus coccif'era;* consists of females, size of a pea, brownish-red; used natively as a dye, and called *kermes, chermes,* or *alkermes;* with tin salts gives scarlet-red precipitate like the official.

2. *Spon'gia officina'lis, Sponge.*—Ceratospongiæ. The fibrous framework, U.S.P. 1820–1850. In seas, attached to rocks, sometimes planted. Animal, the lowest order living in water, composed of amœbiform bodies disposed about a common cavity, with one or more breathing orifices through which water flows in and out. We use the fibrous framework from which the animalcules (gelatinous matter or flesh), gritty and sandy parts have been washed. Sponges are torn from rocks by hands or forks, buried in sand several days to disintegrate animal matter, soaked in water, squeezed, and washed. There are several varieties: 1, Mediterranean, Turkey; 2, Zimocca (coast of Greece); 3, Bathing (N. Africa); 4, Sheep's Wool (Bahama, Florida, Nassau). These are yellowish-brown, but may be bleached by sulphur dioxide, chlorine, sulphurous acid solution, or by dipping them into a 2–3 p. c. solution of potassium permanganate, and washing in a 2–3 p. c. solution of oxalic acid. Sponge contains spongin, also NaCl, $CaCO_3$, Mg, Si, Fe, S, P, Br, I, K, ash 3–4 p. c. Used mechanically for cleansing, washing, absorbing liquids, dilating cavities (sponge tents), supporting parts (pessaries) in dysmenorrhea, to cause premature labor. When compressed usually coated with wax to prevent absorbing moisture, hence expansion. *Spongia Usta, Burnt Sponge;* U.S.P. 1820–1850. Heat sponge in a coffee-roaster until weight is one-fourth less; the residue is mostly charcoal, while 30–35 p. c., the part used, consists of calcium sulphate 25–30 p. c., silica 10 p. c., ferrous oxide 9 p. c., also magnesium carbonate, potassium chloride, calcium phosphate, and sodium iodide .5–1 p. c. Now superseded by iodine.

3. *Sanguisu'ga (Hirudo) medicina'lis,* and *S. officina'lis (quinquestria'ta), Hirudo, Leeches* (Br.).—Annulata. 1, C. and N. Europe (Swedish, German Leech); 2, S. Europe (Hungarian Leech); in fresh-water ponds. These animals are 7.5–15 Cm. (3–6′) long, smooth, soft, round, flattened, composed of 90–100 rings, disk at each end, in the center is the mouth, containing 3 jaws, having many teeth; back olive-green with 6 reddish stripes dotted with black, belly greenish, sides black-spotted or with a black line. The first withdraws a quantity of blood equal to its weight, the second more, while a still larger quantity flows after leech falls off. They disgorge the blood when placed in a solution of salt, although such should not be used again within 6 months. Used for local depletion.

Calcareous Related Products:

1. *Os'trea virginia'na* and *O. ed'ulis, Testa, Oyster-shell.*—Monomya. The inner white layer of the shell, U.S.P. 1830–1870. Atlantic and Indian Ocean coasts. Animal has soft, fleshy, suborbicular body,

enclosed in a calcareous shell opening by a hinge at one end into 2 valves (bivalved), the deeper one adhering to a rock, etc. Shell is rough, gray outside; inside white, glossy, smooth. For medicine (testa præparata) they are boiled, outside layer removed and inside one powdered, separating coarse particles by elutriation; contains calcium carbonate 88–98 p. c., calcium phosphate and sulphate, also Mg, Al, Si, Fe_2O_3. Used as antacid for diarrhea, chronic bowel affections. Dose, gr. 5–30 (.3–2 Gm.).

2. *Oculi'na virgin'ea* and *Coral'lium ru'brum, Corallium, Coral.*—Hexa (Octa)-coralla; Mediterranean Sea, Atlantic Ocean. Polypiferous animals having a skeleton and a fleshy portion. The calcareous skeleton is branched like a shrub, and on these branches are the individual animals in tube-like apertures; skeleton is used in medicine; occurs in hard, cylindrical, branching pieces, porous, striate surface, radiating interior, often hollow, inodorous, tasteless, white (first) or red (second); contains animal matter 8 p. c., $CaCO_3$ 83 p. c., $MgCO_3$ 3.5 p. c., Fe_2O_3 (red coral) 4.25 p. c. Used in tooth powders and as an antacid. Dose, gr. 5–30 (.3–2 Gm.).

3. *Se'pia officina'lis, Os Sepiæ, Cuttle-fish Bone.*—Decapoda; Mediterranean, Atlantic Ocean. A calcareous substance under the skin of the back of the cuttle-fish, often found floating in the water; occurs 12.5–25 Cm. (5–10′) long, 2.5–7.5 Cm. (1–3′) wide, outside hard, smooth; inside porous, friable, inodorous, taste saline; contains $CaCO_3$ 80–85 p. c., NaCl, MgO, $Ca_3(PO_4)_2$. Used as an antacid like chalk, oyster-shell, etc., also in tooth and polishing powders, chiefly now for caged birds to rub (sharpen) their bills against.

4. *As'tacus fluvia'tilis, Crawfish.*—Decapoda; Russia. The stomach of this contains concretions known as *calculi (lapides) cancrorum, crabs' eyes* or *stones,* which are obtained by washing putrefied animals. These are circular, 3–10 Mm. ($\frac{1}{8}$–$\frac{2}{5}$′) broad, plano-convex, white, hard, inodorous, tasteless; contain animal matter 12–15 p. c., calcium carbonate 63 p. c., calcium phosphate 17 p. c. Used as an antacid. Dose, gr. 5–30 (.3–2 Gm.).

2. COLEOPTERA. Coleopterous Order (Family).

Ko-le-op′te-ra. L. pl. of *coleopterum,* fr. Gr. κολεός, a sheath, + πτερόν, a wing—κολεόπτερος, sheath-winged—*i. e.,* insects having the posterior pair of wings membraneous and sheathed by the hardened anterior pair, called *elytra,* which, when folded together, usually form a nearly complete covering of the body. This order (family) includes the beetles and weevils, all of which not only have their 2 pairs of wings arranged as above described, but their mouth parts, forming 2 pairs of jaws (mandibles and maxillæ), adapted for chewing. The larva is variable, having 6 legs or none, no prolegs, pupa inactive; metamorphosis is complete.

Genus: **1. Cantharis.**

CANTHARIS. CANTHARIDES, *U.S.P.*

Cantharis vesicatoria, *(Linné) De Geer.* { The dried insects yielding not less than .6 p. c. cantharidin and not more than 10 p. c. moisture.

Habitat. S. and C. Europe, W. Asia—Spain, Italy, Sicily, S. France, Hungary, S. Russia.

Syn. Canthar., Spanish Flies (Fly), Russian Flies, Blister Beetle, Muscæ Hispanicæ, Lytta vesicatoria; Fr. Cantharide; Ger. Cantharides, Spanische Fliegen, Canthariden, Kanthariden.

Can'tha-ris. L. pl. *cantharides*, a beetle, fr. Gr. *καν θαρίς*, a beetle, Spanish fly —*i. e.*, the classic name.

Ves-i-ca-to'ri-a. L. *vesica*, a blister, of or belonging to or capable of blistering.

Insect.—About 15–25 Mm. ($\frac{3}{5}$–1′) long, 5–8 Mm. ($\frac{1}{5}$–$\frac{1}{3}$′) broad, oblong, compressed above, brilliant green, bluish-green, metallic luster, golden-green beneath; head triangular, mandibles stout, antennæ filiform, of 11 conical joints, the upper black; eyes small, prothorax angulate; legs with 5 tarsal joints; wings membranous, brownish, elytra (wing sheaths) with 2 parallel lines, finely wrinkled; odor strong, disagreeable; taste slight, acrid. Powder, grayish-brown—shining green particles, many long, pointed spicules .5 Mm. ($\frac{1}{50}$′) long, .02 Mm. ($\frac{1}{1250}$′) broad; must not be used when having ammoniacal odor. *Solvents:* alcohol; chloroform. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

Adulterations.—Beetle: Other beetles easily recognizable, exhausted flies, beads, etc.; Powder: Ground euphorbium (gum resin), etc.; all detected by diminished yield of cantharidin and increased amount of ash, which should not exceed 8 p. c.

Commercial.—Females lay eggs in cylindrical holes in the ground, June, the larvæ hatching a week later and depending upon flowers and the resources of the bee for a month, when they burrow in the ground to assume the chrysalis stage and to hatch as perfect beetles next spring. They swarm, May, June, upon trees and shrubs—ash, white poplar, privet, lilac, elder, honeysuckle (Oleaceæ, Caprifoliaceæ), feeding on the leaves, and, having a penetrating odor resembling that of mice, can easily be recognized at a distance. In the early morning, at sunrise, when insects are torpid from the coldness of night and release readily their attachment, persons masked and gloved shake and beat the trees with poles, collecting them in cloths previously spread underneath; they then are plunged into hot water or diluted vinegar, or exposed in a tight vessel to vapors of either vinegar, chloroform, ether, oil of turpentine, ammonia, or carbon disulphide, and thus killed are spread out, dried by sun or ovens, and packed in boxes or casks for market. Russian flies supply the trade, entering commerce via Moscow, Hamburg, Leningrad (Petrograd, St. Petersburg), in barrels (best in paper-lined boxes), being copper-color, larger and more esteemed than those of S. Europe. All blistering beetles should be kept dry, in

air-tight vessels, with a little camphor, chloroform, ether, oil of turpentine, benzene, carbon tetrachloride or disulphide, which protects against the ravages of mite larvæ, etc.

CONSTITUENTS.—Cantharidin, $C_{10}H_{12}O_4$, .4–1 p. c., fat, inert oil (soluble in alcohol), yellow viscid matter (soluble in water and alcohol), volatile principle (giving the odor), yellow substance (soluble in ether, alcohol), black extractive, chlorophyll, phosphates of calcium, magnesium, formic, acetic and uric acids, moisture 10 p. c., ash 6–9 p. c.

FIG. 439.—*Cantharis vesicatoria.*

FIG. 440.—*Cantharis vittata.*

Cantharidin (Cantharidinum—Br.).—Obtained by exhausting with chloroform, evaporating spontaneously; crystals have fat and coloring matter adhering, which are removed by carbon disulphide. Occurs in colorless, odorless, tasteless prisms, soluble in hot alcohol, ether, chloroform, fats, volatile oils, glacial acetic acid, sparingly in water, cold alcohol, sublimable, with alkalies yields cantharidates; cantharidin is the blistering principle and resides mostly in soft parts.

Valuation.—Exhaust with chloroform containing some hydrochloric acid or acetic ether, evaporate, deprive of fat and color by carbon disulphide; should yield cantharidin .4–1 p. c.

PREPARATIONS.—1. *Ceratum Cantharidis.* Cantharides Cerate. (Syn., Cerat. Canthar., Blistering Cerate (Plaster); Br. Emplastrum Cantharidini; Fr. Emplâtre de Cantharides Mitigu'; Emplastrum Vesicans; Ger. Emplastrum Cantharidum ordinarium (vesicatorium), Spanischfliegenpflaster.)

Manufacture: 35 p. c. Macerate in a well-covered container in a warm place, cantharides 35 Gm., oil of turpentine 15 cc. and glacial acetic acid 2.5 cc., previously mixed, then add this to yellow wax 17.5 Gm., rosin 17.5 Gm., benzoinated lard 20 Gm., previously melted and strained; keep in liquid condition over water-bath, stirring occasionally, until reduced in weight to 100 Gm., withdraw heat, stir until firm.

Prep.: 1. *Emplastrum Cantharidis.* Cantharides Plaster. (Syn., Emp. Canthar., Cantharidal Pitch Plaster, Fly Blister;. Br. Emplastrum Cantharidini, .2 p. c., Emplastrum Calefaciens, Warming Plaster; Fr. Emplâtre de Poix Cantharide; Ger. Pechpflaster mit Canthariden.)

COLEOPTERA

Manufacture: Spread cantharides cerate upon adhesive plaster previously spread on fabric—muslin, paper, etc., leaving a margin around the edges; each □ Cm. contains .1 Gm. of cantharides cerate; Br. contains cantharidin $\frac{1}{50}$ p. c.

2. *Tinctura Cantharidis.* Tincture of Cantharides. (Syn., Tr. Canthar., Tincture of Spanish Flies; Fr. Teinture de Cantharides; Ger. Tinctura Cantharidum, Spanischfliegentinktur.)

Manufacture: 10 p. c. Moisten 10 Gm. with alcohol 5 cc., and glacial acetic acid 5 cc., macerate in percolator 24 hours, percolate slowly with alcohol q. s. 100 cc. Dose, ♏j–20 (.06–1.3 cc.).

Unoff. Preps.: Acetum Cantharidini (Br.), cantharidin $\frac{1}{20}$ p. c. *Liquor Epispasticus (Br.)*, cantharidin $\frac{2}{5}$ p. c. *Unguentum Cantharidini* (Br.), cantharidin $\frac{1}{33}$ p. c. *Collodium Cantharidatum*, 60 p. c.

PROPERTIES.—Diuretic, aphrodisiac, emmenagogue, rubefacient, vesicant, acrid poison. Blisters (blebs) are for stimulation, but may produce constitutional symptoms, and if allowed to remain on long depress according to amount of serum discharged, which contains equal quantities of albumin and blood. Absorbed rapidly into the blood and eliminated by the kidneys with marked irritation. Locally causes in 2–3 hours tingling, burning pain, vascular dilatation, and reflexly dilates deep-seated bloodvessels.

USES.—Hectic fever, dropsy, bronchitis, skin diseases, bladder weakness, gleet, vesical catarrh, diabetes, amenorrhea, seminal emissions, gonorrhea, menorrhagia; externally—blisters stimulate the whole or part of the system, prevent accumulation of inflammatory exudations, recall suppressed discharges, are depletory, and thus relieve internal congestions. Applied for ulcers, fistulæ, psoriasis, lupus, erysipelas, boils, alopecia, brain congestion and dropsy, hemorrhage, hydrocele, pleurisy, gleet (under the penis), leucorrhea (sacrum), dysmenorrhea, buboes, abscesses, typhus, typhoid fever, apoplectic condition, inflamed eyes (back of ears), pneumonia, pericarditis, phlebitis, bowel fluxes, rheumatism, neuralgia, spinal irritation, convulsions, tetanus, meningitis, wasting away of muscles, vomiting. Blisters should remain on 4–8 hours, or until skin vesicated, which is aided by previously washing the affected part with soap and applying vinegar. If the spot is to be healed at once, cut off cuticle, absorb serum, which is clear, apply pledget of borated cotton and bandage; if the sore is to be prolonged, remove cuticle, apply simple cerate for 1 day, then basilicon ointment until discharge is purulent, after which continue as long as desired with savin or mezereum ointments. In young persons intractable sores are produced easily by blisters, and in old persons gangrene, hence they should be applied to both with moderation: when such conditions have been produced Goulard's cerate is valuable. Stran-

FIG. 441.—*Mylabris cichorii.*

gury may be avoided by sprinkling plaster with spirit or powdered camphor, sodium bicarbonate, or even powdered cantharides. The tincture is the internal preparation, and the one used in hair lotions.

Poisoning: Have violent gastro-enteritis, abdominal tenderness, burning in pharynx and esophagus, burning pain in back, bladder, and urethra, constriction of throat, great desire to urinate, but urine scanty, mixed with blood and albumin, and passed with pain, vomiting, bloody stools, depression preceded by increased heart force and rapidity, strangury, swollen genitals, increased sexual desire, abortion, convulsions, coma, death. Give vegetable emetics, mucilaginous drinks freely—barley water, flaxseed tea, but not oils or oily emulsions, as these favor solubility and absorption of cantharidin; stimulants (brandy, ammonia, strychnine, atropine), warm baths, and cataplasms to abdomen, opium by mouth, and enema (for pain and gastro-enteritis).

Allied Insects:

1. *Cantharis vitta'ta, Potato Fly;* U.S.P. 1820–1850; United States. Smaller than *C. vesicatoria,* but the two resemble; thorax and wing-cases black, the latter with yellow margin and middle stripe, making 3 yellow bands, head light red with dark spots on top, abdomen and legs covered with cinereous down 12 Mm. ($\frac{1}{2}'$) long. This beetle inhabits Irish (white) potato vines, July–Aug., morning and evening, hiding in the soil during hot hours of the day. Collect by shaking into boiling water; contains cantharidin 1.3 p. c. Used as vesicant like the official. *C. cine'rea* (American; black, closely punctured, covered with ash-gray hairs); *C. margina'ta* (elytra black, margin ash-colored), *C. atra'ta* (black, 8 Mm. ($\frac{1}{3}'$) long), and *C. Nuttal'li,* (Kansas, California; resembles official); wing-cases golden-purple striped with green.

2. *Myl'abris cicho'rii,* and *M. phalera'ta, Chinese Blistering Flies.*—S. and E. Asia. Black wing-cases with 2 orange-yellow bands, and at base 2 yellow spots; powder, blackish-gray, with no glossy-green particles; contains 1–1.7 p. c. cantharidin. Our Pharmacopœia recognizes only 2 insects, cantharis and coccus, while a few countries accept some others: *Æ'nas a'fer,* Spain, has advantage over cantharides in being cheaper, equally powerful, acting without pain, and non-irritating to the urinary organs. *Blat'ta orienta'lis, Cockroach,* Asia, blackish, 2.5 Cm. (1′) long, broad, flat, habits nocturnal; odor disagreeable; oily decoction used for warts, ulcers, boils, scaly eruptions; internally for dyspnea, dropsy, albuminuria, diuretic. Dose, gr. 4–5 (.3 Gm.), per die.

3. HYMENOPTERA. Hymenopterous Order (Family).

Hi-me-nop'te-ra. L. neut. pl. of *hymenopterus,* fr. Gr. ὑμενόπτερος, membrane-winged; ὑμήν, membrane, + πτερόν, wing—*i. e.,* animals have membranous wings. This order (family) includes the highest insects, because of their superior structural development, instinctive faculties, and social qualities. They have 4 membranous wings, the anterior pair being the larger, with a thickened dark spot on their

HYMENOPTERA

front side, few reticulations; the tarsi 4–5-jointed; the tongue or lingua is converted into an organ for sucking honey, liquid food, etc., and the mandibles are adapted to biting or cutting. In bees, wasps, and ants the multivalve ovipositor of the female (workers) is modified into a sting.

Genus: **1. Apis.**

APIS MELLIFERA. THE HIVE OR HONEY BEE.

1. Mel. Honey, *U.S.P.*
2. Cera Flava. Yellow Wax, *U.S.P.*

Apis mellifera, *Linné.*

1. A saccharine substance gathered mostly from nectaries of flowers, and deposited in the honeycomb by the bee. 2. A product obtained by melting and purifying the honeycomb of the bee.

Habitat. N. America, Europe.

Syn. 1. Mel Depuratum, Clarified Honey; Fr. Miel blanc; Ger. Honig. 2. Cer. Flav., Beeswax, Yellow Wax, Cera Citrina; Br. Yellow Beeswax; Fr. Cire jaune; Ger. Cera flava, Gelbes Wachs.

A'pis. L. a bee, Gr. *ἐμπις*, a gnat—*i. e.*, from its classical name.

Mel-lif'e-ra. L. *mellifer*, honey-producing, fr. *mel, mellis*, honey, + *ferre*, to bear.

Animal.—About 15–20 Mm. ($\frac{3}{5}$–$\frac{4}{5}$′) long, 4–5 Mm. ($\frac{1}{6}$–$\frac{1}{5}$′) broad, grayish-brown, chin (mentum) elongated, tongue short, labium and terminal maxillary lobes lengthened into proboscides, labium hastate or cordate. It has been hived from the earliest times for its honey and wax; lives in swarms of 10,000–50,000 individuals, consisting of 3 kinds or classes—perfect females (queen bees), undeveloped females (neuters, working bees), and males (drones). In each swarm there is only one queen bee, much larger than the others, whose sole function is to propagate (laying about 2,000 eggs daily), and at whose death a young, 3-day-old, working bee is selected, her cell enlarged and food changed to royal jelly or paste, whereby she soon grows into a queen—the inspiration center; the drones (several hundred) are gentlemen of leisure—an abundant supply from which the queen may be insured a rightful mate for her own impregnation, when those remaining are destroyed by the neuters, these being the numerous laborers that suck honey from flowers with their proboscides, swallow it with their mouths and later disgorge it into the honey-cells as food for the other bees, old and young—the pollen attaching itself to them simply being utilized as bee-bread for the larvæ. Formerly wax was considered a formation from pollen, but now it is accepted as a secretion from honey. The neuters have a barbed sting attached to a sac of poison (formic acid) which flows into the inflicted wound causing severe pain. When the hive becomes overstocked a new colony is sent out under the direction of a queen bee (swarming).

I. Mel, Honey.—This is a thick, syrupy liquid, yellowish-brown, translucent when fresh, frequently becoming opaque and granular from crystallization of dextrose; characteristic odor; sweet, faintly acrid taste, slightly acid, levorotatory. The honey from hives which never have swarmed is virgin honey, the finest being allowed to drain simply from the comb, the impure grades with the aid of pressure. *Tests:* 1. Diluted with twice its weight of water—moderately turbid, non-stringy, sp. gr. 1.099, corresponding to sp. gr. 1.370 for the original honey. 2. Incinerate 2 Gm.—ash .3 p. c. 3. Boil 2 Gm. + water 20 cc. + 2 drops of iodine T. S.—no blue, green, reddish color (abs. of starch, dextrins). 4. Aqueous solution (1 in 2) + equal volume ammonia T. S.—color not immediately changed (abs. of foreign coloring matter); 5 cc. portion + few drops hydrochloric acid—not red, rose color (abs. of azo dyes). 5. Triturate 1 Gm. with ether 20 cc., filter, evaporate, residue + resorcinol T. S. 1 drop—at most only pink, but no orange, cherry, brown-red color (abs. of artificial honey, added invert sugar). It must be free from foreign substances—parts of insects, leaves, etc. *Impurities:* Starch, dextrins, chloride, sulphate, azo dyes, foreign coloring matter, artificial honey, or added invert sugar. Dose, *ad libitum.*

Constituents.—Grape-sugar or dextrose (becoming crystalline) 32–42 p. c., fruit-sugar or levulose (remaining liquid) 32–42 p. c., wax, volatile oil, proteins, mucilage, coloring matter, formic acid, ash .1–.3 p. c., usually suspended pollen grains.

Preparations.—1. *Mel Rosæ.* Honey of Rose. (Syn., Mellitum Rosatum; Fr. Mellite de Roses rouges, Miel Rosat; Ger. Mel rosatum, Rosenhonig.)

Manufacture: 88 p. c. Mix fluidextract of rose 12 cc. with honey q. s. 100 Gm. Dose, ʒj–2 (4–8 cc.).

Preps.: 1. *Massa Hydrargyri,* 32 p. c. 2. *Mel Rosæ et Sodii Boratis, N.F.,* 85 p. c.

2. *Hydrargyrum Cum Creta,* 10 p. c. 3. *Massa Ferri Carbonatis,* 38 p. c. 4. *Mel Sodii Boratis, N.F.,* 85 p. c. 5. *Confectio Rosæ, N.F.,* 12 p. c. 6. *Pilulæ Digitalis, Scillæ et Hydrargyri, N.F.,* q. s. 7. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N.F.,* q. s. 8. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, N.F.,* q. s. 9. *Pilulæ Opii, Digitalis et Quininæ, N.F.,* q. s. 10. *Pilulæ Opii et Camphoræ, N.F.,* q. s. 11. *Pilulæ Opii et Plumbi, N.F.,* q. s.

Unoff. Prep.: Oxymel (Br.)—purified honey 5, acetic acid 1, distilled water 1; sometimes used in cough mixtures, dose, ʒj-2 (4–8 cc.).

Properties and Uses.—Demulcent, laxative; externally stimulant, nutritive, relieves dryness of mouth, facilitates swallowing; in gargles for aphthæ, thrush, pseudomembranous deposits; in poultices for boils, carbuncles, fissures of nipples; in plasters for drying up mammary secretion.

II. Cera Flava, Yellow Wax.—The honeycomb, after draining the honey, is melted in water, impurities allowed to subside, then

cooled; a second or third melting produces each time a purer product. It is a yellow, gray-brown solid, agreeable, honey-like odor, faint characteristic taste, somewhat brittle when cold, fracture dull, granular, not crystalline, plastic by heat of hand, soluble in chloroform, ether, fixed or volatile oils, partly in benzene, carbon disulphide, sparingly in alcohol, when boiling dissolving cerotic acid and part of the myricin; insoluble in water; sp. gr. 0.955, melts at 63° C. (146° F.). *Impurities:* Fats, fatty acids, Japan wax, rosin, soap, paraffin, spermaceti, lard, starch, meal, water, ceresin—this latter most frequently, 10–45 p. c.

Constituents.—Hydrocarbons, $C_{27}H_{56}$ and $C_{34}H_{64}$, 12–14 p. c., cerin or cerotic acid, $C_{27}H_{54}O_2$, crystallizes from boiling alcohol; myricin or myricyl palmitate, $C_{30}H_{61}C_{16}H_{31}O_2$ (principal constituent, acicular crystals, soluble in hot ether), an alcohol, $C_{25}H_{52}O$, ceryl alcohol, $C_{27}H_{56}O$.

Preparations.—1. *Cera Alba.* White Wax. (Syn., Cer. Alb., Bleached (White) Beeswax; Fr. Cire blanche; Ger. Cera alba, Weisses Wachs.)

Manufacture: Yellow wax, in thin sheets, is bleached by exposure to moisture, air, and sunlight. It is a yellowish-white solid, somewhat translucent in thin layers, faint characteristic odor, nearly tasteless, non-rancid; sp. gr. 0.955, melts at 63° C. (146° F.).

Preps.: 1. *Ceratum,* 30 p. c. 2. *Unguentum Aquæ Rosæ,* 12 p. c. 3. *Ceratum Camphoræ, N.F.,* 35 p. c. 4. *Petroxolinum Spissum, N.F.,* 35 p. c.—white wax 35 Gm., light liquid petrolatum 20, oleic acid 32, oil of lavender 3, alcohol 5, stronger ammonia water 5. 5. *Unguentum Camphoræ, N.F.,* 11 p. c. 6. *Unguentum Sinapis, N.F.,* 15 p. c.

2. *Emplastrum Adhæsivum.* Adhesive Plaster. (Syn., Emp. Adhæs., Emplâstrum Elasticum, U.S.P. 1910, Rubber Adhesive Plaster; Fr. Emplâtre Caoutchouc; Ger. Kautschukpflaster.)

Manufacture: A mixture of rubber, resins and waxes, with a filler of an absorbent (zinc oxide, orris root, starch), mechanically mixed and spread upon cotton cloth.

3. *Ceratum Cantharidis,* 17.5 p. c. 4. *Ceratum Resinæ,* 15 p. c. 5. *Unguentum,* 20 p. c. + benzoinated lard 80 p. c. 6. *Unguentum Acidi Borici,* 5 p. c. 7. *Unguentum Belladonnæ,* 5 p. c. 8. *Unguentum Phenolis,* 5 p. c. 9. *Unguentum Picis Pini,* 15 p. c. 10. *Ceratum Resinæ Compositum, N.F.,* 22.5 p. c.

Properties and Uses.—Mostly as bases for plasters, cerates, ointments; formerly in diarrhea, dysentery, rheumatism, gleet, neuralgia; locally as a protective from cold and to aid cutaneous transpiration.

Allied Insect:

1. *Formi'ca ru'fa, Red Ant.*—Formicidæ. This small insect lives in communities burrowed in the ground or in wood, where it constructs chambers for storing food and raising the young; males are short-lived and with wings, females (queens) soon lose theirs but live longer; there are one or more kinds of workers, and soldiers—all forms

of underdeveloped females. They have remarkable habits, approximating the bee but less intelligence. Some have stings, others eject, when irritated, a fluid rich in formic acid, which has decided medicinal value, and which for a long time proved our only source. It was found that the application of many enclosed in a linen bag, infused in hot bath, or thrusting the foot or hand into their hills for several hours, greatly relieved chronic gout, rheumatism and paralytic affections, hence its demand.

Acidum Formicum, Formic Acid, N.F.—An aqueous solution, containing 24–26 p. c. of HCOOH, obtained by (1) distilling with steam red ants, (2) oxidizing methyl alcohol, (3) saponifying chloroform with KOH, (4—best) distilling glycerin 50 Gm. with oxalic acid 100, +, thus forming glyceryl formate, and finally formic acid which distils over. It is a clear, colorless liquid, acid reaction, characteristic pungent odor, miscible with water or alcohol; sp. gr. 1.058; warmed with mercuric chloride T. S.—white precipitate (mercurous chloride). *Impurities:* Acetic acid, acrolein, allyl formate, chloride, sulphate, oxalic acid, sulphurous acid, heavy metals. Caustic, irritant, counter-irritant, astringent, diuretic, stimulant to stomach and kidneys; sweating of feet, syncope, rheumatism, cancers, diphtheria, tuberculosis, muscular tremors—senile, toxic paralysis agitans. Dose, ♏j–5 (.06–.3 cc.); 1. *Spiritus Acidi Formici*, Spirit of Ants, 4 p. c. + 77.5 p. c. alcohol q. s. 100., dose, ʒss–1 (2–4 cc.).

Subkingdom II. **VERTEBRATA.**

Class 2: **PISCES.** L. pl. of *piscis*, a fish. This class includes the oviparous animals that have fins and a covering of scales or plates. They breathe by gills, live almost entirely in water, swim instead of walking or flying, have a complete cranium, and a lyriform shoulder girdle.

4. TELEOST(EÆ)-IA. Teleostean Order (Family).

Tel-e-os'te-e. L. *teleosteus*, fr. Gr. τέλεος, complete, + οστέον, a bone—*i. e.*, has a well-ossified skeleton, like ordinary fishes. This order (family) has well-developed brain, optic nerves cross each other, but without any chiasm; heart has a non-contractile arterial bulb, fins have well-developed and distinct rays; skeleton is completely ossified, the backbone being composed of well-ossified vertebræ.

Genus: **1. Gadus.**

OLEUM MORRHUÆ. COD-LIVER OIL, *U.S.P.*

Gadus Morrhua, *Linné,* and other species. } The fixed oil obtained from the fresh livers.

Habitat. N. Atlantic Ocean.

Syn. The Cod (fish), Ol. Morrh., Oleum Hepatis Morrhuæ, Cod Oil; Fr. Huile de Foie de Morue, Huile de Morue; Ger. Oleum Jecoris Aselli, Lebertran, Stockfischlebertran.

Ga'dus. L. a codfish, Gr. γάδος, same as όνος, L. *asellus*, a certain kind of fish.

Mor'rhu-a. L. a cod (fish), fr. *morua, mortua*, ult. *merula*.

TELEOST(EÆ)-IA

ANIMAL.—The common codfish is .6–1 M. (2–3°) long, with brown or yellowish spots on the back; body somewhat elongated and compressed, with soft small scales, none being on the head; fins soft, 3 on the back, 2 anal, and 1 distinct caudal; teeth irregular, pointed, in several ranks; gills large, 7-rayed.

Oleum Morrhuæ, Cod-liver Oil.—It is a pale yellow, thin, oily liquid, peculiar, slightly fishy, but not rancid odor, fishy taste, soluble in ether, chloroform, carbon disulphide, ethyl acetate, slightly in alcohol, sp. gr. 0.923. *Tests:* 1. Dissolve 1 drop in chloroform 1 cc., shake with 1 drop of sulphuric acid—violet-red tint, gradually changing to reddish-brown. 2. Allow 2–3 drops of fuming nitric acid to flow alongside of 10–15 drops of oil—reddish, purplish color at zone of contact, changing to bright rose-red on stirring (dist. from seal oil, which shows no change, and other fish oils, which become blue). Should be kept cool, in well-closed containers, having been well dried before filling. Dose, ʒj–4 (4–15 cc.).

ADULTERATIONS.—Allied fish oils (seal, shark, menhaden, haddock, skate, etc.), other fixed oils, rosin (soluble in alcohol), paraffin oil (saponifies with potassium hydroxide in alcoholic solution), free fatty acids, lard oil.

Commercial.—The codfish abounds in the waters off Newfoundland, Norway, Nova Scotia, New England, north of Boston, where several species of *Gadus* are used for the oil: *G. calla'rias* (*Morrhua america'na*, Dorsch), *G. carbona'rius* (Coalfish), *G. polla'chius* (Pollack), *G. merlu'cius* (Hake), *G. æglef'inus* (Haddock). Fishermen in small boats do most of the catching, Dec.-March, and upon reaching shore clean and salt the fish, reserving livers for the oil, which may be rendered in an atmosphere of carbon dioxide to prevent oxidation, or more frequently by simply boiling livers with water or superheated steam to disintegrate tissue and allow the oil to separate to the surface, above the aqueous substratum, when it can be drawn off, strained, and run into butts in the cooling-room, where, after freezing to a solid, it is expressed through canvas bags, and then barrelled or bottled for market as *shore*, *white*, *pale yellow oil*, the hard, yellow residue (stearin, liver *débris*) being sold for soap-making. Frequently large boats remain for weeks at sea collecting and salting the fish, for food, throwing offal overboard, and the livers into barrels to become decomposed, thus disintegrating tissue and separating the oil, which, rising to the surface, is racked off and bottled, being, darker and less sweet than the preceding, and known as *straits*, *brownish-yellow oil*. The remaining putrid *débris* may be heated with steam or water, giving a black oil of offensive odor and taste, and known as *banks*, *dark brown oil*. The oil-extracting is conducted on shore by individuals in a small way, or by large factories, either near the seat of capture or at remote points supplied with livers in refrigerator cars. Oil of good quality may be obtained by simply boiling livers in water to a pulp, straining through canvas, subsidence, decanting, and filtering. Cod-liver Oil may be

assayed for its vitamin A potency, and should contain at least 50 units per Gm., and when so assayed must be labeled: "This unit is not a measure of the antirachitic activity of Cod-liver Oil."

CONSTITUENTS.—Chiefly olein (physetolein) 70 p. c., palmitin 25 p. c., little stearin, palmitic acid 4 p. c., jecoleic acid, $C_{19}H_{36}O_2$, 20 p. c., therapic acid, $C_{17}H_{26}O_2$, iodine .001-.002 p. c., 3 alkaloids—trimethylamine, C_3H_9N, aselline, $C_{25}H_{32}N_4$, morrhuine, $C_{19}H_{27}N_3$ (diuretic, diaphoretic), cholesterol .5–1.5 p. c., traces of chlorine, bromine, phosphorus, sulphur .3 p. c., cholesterin, morrhuic acid (gaduine), $C_9H_{13}O_3N$, probably butyric and acetic acids. With alcohol (90 p. c.) oil yields 3.5–6 p. c. of extract called *morrhuol* (gaduol), in which active virtues reside.

PREPARATIONS.—1. *Emulsum Olei Morrhuæ.* Emulsion of Cod-liver Oil. (Syn., Emuls. Ol. Morrh.; Fr. Emulsion de Huile de Foie de Morue; Ger. Emulsio Olei Jecoris Aselli, Lebertranemulsion.)

Manufacture: Rub acacia 12.5 Gm. with cod-liver oil 50 cc., in dry mortar until mixed, add at once water 25, triturate lightly and rapidly by hand, or suitable mechanical device, until complete emulsification, add methyl salicylate .4, syrup 10, water q. s. 100; may replace methyl salicylate by any other flavoring ingredient, as oil of bitter almond, etc. Dose, ʒj–4 (4–15 cc.).

2. *Emulsum Olei Morrhuæ cum Hypophosphitibus, N.F.*, 50 p. c. + calc. hypophos. 1, pot. hypophos. .5, sod. hypophos. .5, acacia 12.5, ol. betula. vol., or ol. aurant. amar. .4–.5 cc., syrup 10, water q. s. 100. Dose, ʒj–2 (4–8 cc.). 3. *Emulsum Olei Morrhuæ cum Malto, N.F.*, 30 p. c., + trag. $\frac{3}{10}$ p. c., water 15, ext. malt q. s. 100. 4. *Emulsum Olei Morrhuæ cum Vitello, N.F.*, 50 p. c., + glycer. vitell. 17.5 p. c., syr. tolu 10, alcohol 12, flavoring, water q. s. 100. Dose, each, ʒij–4 (8–15 cc.).

Unoff. Preps.: Emulsions of various forms and combinations.

PROPERTIES.—Alterative, demulcent, emollient, nutrient. Owing to it already having been prepared by the liver, therefore partly elaborated, it is the most easily digested of the fats; increases red blood corpuscles, body-weight, and healthy cell-formation throughout the tissues; pancreatic juice resolves it into glycerin and fatty acids, the latter unite with alkalies of the bile and intestinal juice, forming soaps, the larger portion, however, is emulsionized by alkaline secretions of the intestines. It is absorbed readily by the skin, and large doses may occasion diarrhea.

USES.—Wasting diseases, chronic phthisis, bronchitis, rheumatism, skin diseases, neuralgia, chorea, epilepsy, nerve tonic, convalescence from acute diseases, scrofula, white swelling, chronic arthritis (gout).

To take internally may disguise odor and taste: 1, Emulsion + oil of bitter almond (1 to 250); 2, Porter ʒj (30 cc.) + oil + plenty froth on top; 3, Orange- or lemon-peel chewed before and after taking; 4, Common salt, or a chew of salted or smoked herring before taking; 5, With soup or made into bread, jelly; 6, On surface of whisky, with a

TELEOST(EÆ)-IA

gulp. If oil nauseates, give before each dose potassium cyanide gr. $\frac{1}{8}$ (.008 Gm.), or lime water ℥iv (15 cc.), or bismuth subnitrate gr. 15–30 (1–2 Gm.).

Allied Oils:

1. *Oleum Squali, Shark Oil.*—From the liver of the shark—*Squa'lus Carcha'rias;* light yellow, limpid at —6° C. (12.2° F.).

2. *Oleum Rajæ, Ray Oil, Skate Oil.*—From livers of *Ra'ja Ba'tis.* France, Belgium; pale yellow, said to contain more iodine than cod-liver oil.

3. *Oleum Ceti, Sperm Oil.*—From *Physeter macrocephalus;* yellowish, in cold deposits spermaceti and stearin.

4. *Oleum Balænæ, Whale Oil.*—From *Balæ'na mystice'tus* and *B. austra'lis;* deposits at 10° C. (50° F.).

Allied Animals and Products:

1. *Ichthyocolla, Isinglass.*—The swimming-bladder of *Acipen'ser Hu'so,* and other species, U.S.P. 1820–1890. Sturiones. Large fish, 4–4.5 M. (12–15°) long, weighing 1000 pounds (455 Kg.) or more, and ranking with whales as regal or royal fishes. Swimming-bladder (isinglass) occurs in separate sheets, or rolled, horny, pearly, whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; 1 part + 24 boiling water forms on cooling a transparent jelly. This swimming-bladder ("sound") is a membranous bag (in front of the abdomen of most fishes) containing oxygen and nitrogen in various proportions, which enables the fish, by contracting or expanding, to lower or raise themselves in water; this bag consists of 3 coats: 2 inner (thin, delicate), 1 outer (rough, silvery-white); this latter is scraped off, discarded, and the inner bladder dried by (1) stretching into sheets, *leaf isinglass,* (2) folding several together, *book isinglass,* or (3) folding up around pegs, *long* or *short staple isinglass;* contains gelatin (glutin), insoluble membrane 2–30 p. c., ash .5 p. c.; solvents: boiling water, boiling diluted alcohol. Emplastrum Ichthyocollæ (Court Plaster)—Dissolve isinglass 10 Gm. in hot water q. s. 120 Gm.; with brush spread half of this in successive layers upon taffeta (stretched), add to other half alcohol 40 Gm., glycerin 1, apply as before, coat reverse side with tincture of benzoin. Nutritious, emollient, protective. Used in bowel derangements (children), mixed with farinaceous food, in clarifying liquors, to impart luster to fabrics, as a test for tannin; plaster for cuts, abrasions, skin eruptions. Dose, *ad libitum;* Coxe's, Nelson's, as dietetic.

2. *American Isinglass.*—Sounds of *Ga'dus merluc'cius* (Hake) and *Otol'ithus rega'lis* (Weakfish), dried in thin sheets or ribbons.

3. *Purse* or *Pipe Isinglass.*—Dried fish-sounds without being cut open. Used sometimes in the arts as isinglass.

4. *Japanese* or *Chinese Isinglass* (Agar-agar).—A vegetable product from *Gelidium corneum,* and other marine Algæ, see page 55.

5. *Chondrin.*—This resembles gelatin, being from cartilages of the ribs and other non-ossifying cartilages; its aqueous solution is precipi-

tated by alum, lead acetate, ferric salts, acetic and mineral acids, but not by tannin or mercuric chloride; used as emollient, nutritive, protective, as the basis for suppositories, pessaries, bougies, capsules, lozenges, pill-coating, etc. Differs from gelatin in containing less nitrogen, more oxygen, in precipitating with acetic and mineral acids, but not with tannin.

6. *Gal'lus Ban'kiva* var. *domes'ticus.*—Gallinæ; Java, Cochin-China. Animal, known as the domesticated or dunghill fowl, originated from the red jungle-fowl, to which our nearest approach is the game-cock. The eggs consist of *yolk* 30 p. c., *albumen* 60 p. c., *shell* 10 p. c. and furnish 3 semi-official products: I. *Ovum Gallinaceum, Fresh Egg, N.F.*—The recently laid egg of the hen: Prep.: 1. *Linimentum Terebinthinæ Aceticum.* II. *Ovi Vitellum Recens, Fresh Egg Yolk, N.F.*—The freshly separated yolk of the recently laid egg of the hen. Yolk of egg (vitellus) is a viscid, yellow, opaque, alkaline liquid—being an emulsion of oil suspended in water by albumen; coagulates by heat and upon the addition of alcohol; gives whitish emulsion with water; yields to ether yellow fat and separates a white mass; odorless, bland taste; contains water 48–55 p. c., vitellin 16 p. c. (a protein related to casein, mixed with albumen), fat 30 p. c., inorganic salts 1.5 p. c. (chlorides, sulphates, and phosphates of potassium, sodium, calcium, magnesium), cholesterin .42 p. c., lecithin, coloring matter, lactic acid, sugar; 1. *Glyceritum Vitelli,* 45 p. c. + glycerin 55—mix thoroughly in mortar, strain: Preps.: 1. *Emulsum Olei Morrhuæ cum Vitello.* 2. *Linimentum Terebinthinæ Aceticum.* III. *Ovi Albumen Recens, Fresh Egg Albumen, N.F.*—The freshly separated liquid white, or albumen, of the recently laid egg of the hen; it weighs ʒv–6½ (20–25 Gm.); contains water 82–88 p. c., solids 12–18 p. c., mostly albumen, little fat, sugar, extractive, ash .65 p. c., of which 42 p. c. is KCl and 9 p. c. NaCl, the remainder being carbonates, phosphates, sulphates of alkalies, calcium, magnesium, and iron: Preps.: 1. *Linimentum Opii Compositum,* 5 p. c.; 2. *Linimentum Terebinthinæ Aceticum.* Properties (yolk): nutritious, laxative; jaundice, dyspepsia; chiefly in pharmacy for emulsionizing oils, dressing for burns, scalds, abrasions, to soften cutaneous crusts, cerumen in the ear. Dose, 1–2 yolks; (white): nutritious, clarifies honey, syrup, and other liquids, an antidote to metallic poisons (mercuric chloride, copper salts, etc.). *Testa Ovi, Egg-shell.*—Composed of calcium carbonate 90–97 p. c., calcium and magnesium phosphates 1–5.7 p. c.; organic matter 2–4.7 p. c. It is antacid; once popular remedy for gravel.

7. *Ingluvin.*—This is claimed to be a bitter principle contained in the fowl's gizzard, or simply—the gizzards cleaned, dried, and pulverized. Dose, gr. 5–15 (.3–1 Gm.).

Albumini Tannas. Albumin Tannate, U.S.P.—(Syn., Album. Tan., Albutannin, Tannalbinum, Albuminis tannas, Albuminum tannicum; Ger. Tannalbin.) A compound of albumin and tannic acid.

CETACEA

Manufacture: Add 10 p. c. aqueous solution of egg albumen (10) to 10 p. c. aqueous solution of tannic acid (6.5), warm mixture, filter, wash precipitate until free from excess of tannic acid, dry, powder, heat for 6 hours at 126° C. (259° F.). It is a yellowish-white, odorless powder, almost insoluble in water, alcohol, chloroform, ether, decomposed by aqueous solutions of alkali hydroxides and carbonates; ash .3 p. c.; dry for 3 hours—loss 6 p. c. *Test:* 1. Shake for 5 minutes 1 Gm. with 50 cc. distilled water; 25 cc. of filtrate requires for neutralization 1 cc. $\frac{N}{10}$ sodium hydroxide, 3 drops phenolphthalein T. S. indicator (abs. of free acid). *Impurities:* Free acid, soluble substances. Should be kept dark. Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses.—Astringent; serous, chronic diarrheas, chronic enteritis, including small intestine and colon, etc.; not dissolved in stomach but slowly decomposes in the intestines thus setting free tannic acid to act as a mild astringent throughout the alimentary canal.

Class 3: **MAMMALIA.** L. fr. *mammalis*, of the breast. The highest class of vertebrata. Distinguished by all being warm-blooded, viviparous, suckling their young by a mammary gland, nipples, breathing by lungs.

5. CETACEA. Cetaceous Order (Family).

Se-ta'se-a. L. *cetus*, Gr. κῆτος, a whale—*i. e.*, pertaining or belonging to the whale. All animals of this order (family) have pelvis and hind limbs somewhat atrophied, a fish-like body, specialized for aquatic progression, ending in a horizontal tail or flukes; short fore-limbs like fins or flippers, 1 at least of the digits with more than 3 phalanges; neck usually short; some of the cervical vertebræ anchylosed together.

Genus: **1. Physeter.**

CETACEUM. SPERMACETI, *U.S.P.*

Physeter macrocephalus, *Linné.* { A fatty substance obtained from the head of the sperm whale.

Habitat. The Pacific and Indian Oceans; Seas of Australia.

Syn. Cetac., The Sperm Whale; Fr. Blanc de Baleine, Cétine, Spermacéti, Ambre blanc; Ger. Cetaceum, Walrat, Spermaceti, Wallrath.

Phy-se'ter. L. fr. Gr. φυσητήρ, a blow-pipe, a kind of whale; φυσᾶ, a pair of bellows, wind; φυσᾶν, blow—*i.e.*, the sperm whale has a blow-hole near the edge of the snout.

Mac-ro-ceph'a-lus. L. fr. Gr. μακρής, large, + κεφαλή, head—*i. e.*, animal has a very large head.

Animal.—Usually 18–24 M. (60–80°) long, enormous head, being often 9 M. (30°) in circumference, and composing one-third its whole

length; in front of the cranium the upper jaw has a large cavity containing an oily liquid, which, being removed in buckets shortly after death, congeals into a yellow mass. It is drained in suitable bags, pressed to remove oil, press-cake purified by melting in water, impurities skimmed off, boiled with weak potassium hydroxide solution, washed with water, and allowed to congeal.

Cetaceum, Spermaceti.—This (as thus congealed) is in white, somewhat translucent, slightly unctuous masses, crystalline fracture, pearly luster, faint odor, bland, mild taste, free from rancidity—yellowish and rancid on exposure, sp. gr. 0.941, melts at 42–50° C. (108–122° F.), soluble in boiling alcohol, ether, chloroform, carbon disulphide, fixed or volatile oils, slightly in petroleum benzin, insoluble in water, nearly so in cold alcohol. *Impurities:* Paraffin; stearic acid.

Constituents.—Mainly cetylic alcohol or ethal, $C_{16}H_{33}OH$, combined with palmitic acid, $HC_{16}H_{31}O_2$, forming a fat, cetin (cetyl palmitate), $C_{16}H_{33}.C_{16}H_{31}O_2$, also small amounts of fat containing stearic, myristic, and lauro-stearic acids.

Preparations.—1. *Unguentum Aquæ Rosæ*, 12.5 p. c.

Unoff. Preps.: Ceratum, 10 p. c., + white wax 35, olive oil 55. *Unguentum Cetacei* (Br.), 20 p. c. + white beeswax 8, liquid paraffin 72.

Properties and Uses.—Lenitive, demulcent, emollient, as a basis for ointments, cerates, etc., alvine and urinary derangements. May be given in emulsion with egg-yolk or almond oil, or powder made by rubbing down with alcohol or little almond oil.

Derivative Product:

1. *Ambra Grisea, Ambergris.*—This is a morbid excretion found in the intestines of the sperm whale, also floating on the sea; a single whale has produced 750 pounds (340 Kg.). It is in irregular masses, 60–225 pounds (28–103 Kg.) the largest, brownish-gray color, with lighter and darker streaks and spots, fusible in hot water, friable in the cold, sp. gr. 0.800–0.920; soluble in ether, fats, volatile oils, hot alcohol, insoluble in potassium hydroxide solution; odor peculiar, fragrant, nearly tasteless; contains ambreïn (fatty substance resembling cholesterin) 85 p. c., balsamic extractive, sodium chloride, benzoic acid (?), coloring matter, little ash. Stimulant, antispasmodic; mostly in perfumery, for fixing odor. Dose, gr. 5–15 (.3–1 Gm.).

6. PACHYDERMATA. Pachyderma(l)-tous Order (Family).

Pak-i-der'ma-ta. L. fr. Gr. παχύς, thick, + δέρμα(τ), skin. All animals of this order (family) have thick skin, are non-ruminant (do not chew the cud), ungulate mammals, or hoofed quadrupeds, such as elephants, hippopotamuses, swine, rhinoceroses, hyraxes, tapirs, horses, etc.

Genus: **1. Sus.**

PACHYDERMATA

SUS SCROFA. THE HOG.

1. Adeps. Lard, *U.S.P.*
2. Pancreatinum. Pancreatin, *U.S.P.*
3. Pepsinum. Pepsin, *U.S.P.*

Sus scrofa var. **domesticus,** *Gray.*

1. The purified internal fat of the abdomen of the hog. 2. A substance containing enzymes, principally amylopsin, trypsin, steapsin, obtained from fresh pancreas of the hog, or ox. 3. A substance containing a proteolytic enzyme (ferment) obtained from glandular layer of the fresh stomach of the hog.

Habitat. Domesticated from the wild boar and closely related forms; universal.
Syn. 1. Br. Adeps Præparatus, Axungia, Axungia Porci (Porcina), Prepared (Hog's) Lard; Fr. Axonge, Graisse de Porc, Saindoux; Ger. Adeps suillus, Schweineschmalz. 2. Pancreat.; Fr. Pancreatine (médicinale); Ger. Pancreatin. 3. Fr. Pepsine; Ger. Pepsin.
Sus. L. fr. Gr. *ὗs*, a hog, pig—*i. e.*, the Linnean name of the genus.
Scrof'a. L. a breeding sow—*i. e.*, its classic name.
Do-mes'ti-cus. L. domesticated, belonging to the household, fr. *domus*, house.

Animal.—About .6–1.3 M. (2–4°) long, .3–1 M. (1–3°) high, weighing from 15–800 pounds (7–365 Kg.), sometimes with side tusks (long canines); color iron-gray, white, or black, with long, drooping ears and more or less elongated snout. It is very important to man for its meat, fat, and entrails.

I. Lard: This fat is from the mesentery, omentum, and kidneys of winter-killed hogs; it is deprived of blood, external membranes, cut into small pieces, and heated on water-bath until melted, then strained through flannel. To make inodorous, may add to each pound (.5 Kg.) of melted lard, alum 15 gr. (1 Gm.) and sodium chloride 30 gr. (2 Gm.), boil until scum rises, remove this, strain, cool, work on slab with a stream of water to remove salts, remelt, and heat until all water is dissipated. It is a soft, white, unctuous mass, faint odor; non-rancid, bland taste; soluble in ether, chloroform, carbon disulphide, petroleum benzin, slightly in alcohol, insoluble in water; melts at 39° C. (102° F.) to a clear liquid, from which no aqueous layer separates. *Tests:* 1. Boil with distilled water—latter not alkaline (abs. of alkalies). 2. Boil 1 Gm. with alcohol (20), cool, filter, + 5 drops of alcoholic solution of silver nitrate (1 in 50)—slight turbidity (abs. of chlorides). *Impurities:* Alkalies (Na_2CO_3), chlorides (NaCl), free fatty acids, cottonseed fats, tallow, etc. Should be kept cool, in well-closed containers impervious to fat.

Constituents.—Olein (Oleum Adipis, U.S.P. 1900) 50–60 p. c., palmitin, stearin.

Preparations.—1. *Adeps Benzoinatus.* Benzoinated Lard: lard 100 Gm., Siam benzoin 1 Gm. See page 471.

Preps.: 1. *Ceratum.* Cerate. (Syn., Cerat., Simple Cerate, Ceratum Simplex (Adipis); Fr. Cerat simple; Ger. Unguentum cereum, Wachssalbe, Einfaches-cerat.)

Manufacture: Melt on water-bath white wax 30 Gm., add benzoinated lard 70 Gm., heat until liquefied, strain, stir constantly until congealed. When for hot-weather use, may replace 5–10 p. c. of benzoinated lard by white wax.

2. *Unguentum.* Ointment. (Syn., Ung., Simple Ointment, Unguentum Simplex (Adipis); Fr. Pommade simple; Ger. Unguentum cereum, Wachssalbe.)

Manufacture: Melt yellow wax 20 Gm., add benzoinated lard 80 Gm., heat gently until liquefied, stir until congealed. When for hot-weather use, may replace 5–10 p. c. of benzoinated lard by white wax.

Preps.: 1. *Unguentum Acidi Tannici,* 60 p. c. 2. *Unguentum Gallæ,* 80 p. c. 3. *Unguentum Hydrargyri Mite,* 20 p. c. 4. *Unguentum Calaminæ,* Turner's Cerate, *N.F.,* 83 p. c.

3. *Unguentum Hydrargyri Fortius,* 25 p. c. 4. *Unguentum Sulphuris,* 85 p. c. 5. *Ceratum Camphoræ, N.F.,* 40 p. c. 6. *Mulla Acidi Salicylici, N.F.,* 10 p. c. 7. *Mulla Hydrargyri Chloridi Corrosivi, N.F.,* 5 p. c. 8. *Mulla Zinci, N.F.,* 20 p. c. 9. *Pasta Zinci Sulphurata, N.F.,* 70 p. c. 10. *Unguentum Plumbi Iodidi, N.F.,* 90 p. c. 11. *Unguentum Potassii Iodidi, N.F.,* 80 p. c. 12. *Unguentum Stramonii, N.F.,* 65 p. c. 13. *Unguentum Sulphuris Alkalinum, N.F.,* 65 p. c. 14. *Unguentum Veratrinæ, N.F.,* 90 p. c.

2. *Ceratum Resinæ,* 50 p. c. 3. *Unguentum Camphoræ, N.F.,* 67 p. c. 4. *Unguentum Hydrargyri Nitratis,* Citrine Ointment, *N.F.,* 76 p. c. 5. *Unguentum Picis Compositum, N.F.,* 32 p. c. 6. *Unguentum Sinapis, N.F.,* 83 p. c. 7. *Unguentum Sulphuris Compositum, N.F.,* 30 p. c.

Properties and Uses.—Lard is emollient. Employed mostly externally as a basis for ointments, cerates, and to preserve softness of poultices. The benzo(in)ated lard does not become rancid quickly by exposure, consequently this property and its odor particularly commend it.

II. Pancreatin (Zymine): This may be extracted similarly to pepsin by macerating the finely minced fresh pancreas (sweet-breads) in acidulated (HCl) water, and separating with sodium chloride, or may be mixed with cold water, kneaded for an hour, filtered through flannel, and equal volume of alcohol added; the precipitate is drained, dried on trays at 40° C. (104° F.), then powdered. If instead of the water we use water saturated with chloroform, decomposition will be greatly retarded; may also rub up the product with lactose without heat, which will keep it dry and prevent decomposition. It is a cream-colored, amorphous powder, faint, characteristic, but not offensive

odor, slowly and incompletely soluble in water, insoluble in alcohol; acts best in neutral or faintly alkaline media; more than traces of mineral acids or large amounts of alkali hydroxides render it inert, while excess of alkali carbonates and pepsin solutions inhibit its action. It consists principally of amylopsin, trypsin, steapsin (myopsin, rennin) and converts not less than 25 times its weight of starch into soluble carbohydrates (dextrins and sugars that are soluble in water) and not less than 25 times its weight of casein (protein) into proteoses (water soluble); the myopsin and trypsin—change proteins (albuminoids) into proteoses (peptones), the amylopsin—starch into dextrins and sugars, the steapsin—emulsifies fat, and the rennin (renfer)—coagulates milk. *Test:* 1. 5 gr. (.3 Gm.) should emulsify cod-liver oil ʒj (4 cc.). *Impurities:* Fat, etc. When of a higher digestive power it may be reduced to the standard with lactose. It should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Preparations.—1. *Liquor Pancreatini, N.F.,* 1.75 p. c. + sod. bicarb. 5, mag. carb. .8, sod. chloride .5, alcohol 6.5, chloroform .2, sp. card. co. .35, aq. dest. q. s. 100. Dose, ʒj–2 (4–8 cc.). 2. *Pulvis Pancreatini Compositus, N.F.,* 20 p. c. + sod. bicarb. 80; 1.5 Gm. (23–25 gr.) will peptonize 500 cc. (Oj) fresh milk.

Properties and Uses.—It was used first in medicine for its emulsifying properties, hence of service as a ferment in dyspepsia and in the pre-digestion of food—milk, beef, oysters, arrowroot, barley, oatmeal, wheat, etc. Useful to assist the digestion of infants, invalids, old persons, and those prostrated by fever or exhaustion. Thus to peptonize or pre-digest milk, take pancreatin gr. 5 (.3 Gm.), sodium bicarbonate gr. 20 (1.3 Gm.), warm water ʒj (30 cc.) and when dissolved add it to warm milk Oj (.5 L.); keep temperature at 43° C. (110° F.) for an hour.

III. Pepsin: This may be made by several processes (yielding two kinds—*precipitated* and *scale* or *soluble*), each producing pepsin of different digestive strength. The original method consisted in chopping up finely the inside mucous membrane of the pig's stomach and macerating it in acidulated (HCl) water for several days; the liquid portion is strained off, and to it sodium chloride is added; this precipitates the pepsin, which, rising to the surface, is skimmed off, pressed, and dried. A more modern method employs sodium sulphate (instead of sodium chloride), which, together with peptone, is removed by dialysis, then residual solution concentrated and dried on glass plates. It is in lustrous, white, pale yellow, transparent, translucent scales, granules, spongy masses, or a fine, white, cream-colored, amorphous powder, free from offensive odor, slightly acid or saline taste, slightly hygroscopic; freely soluble in water, solution being acid and opalescent, nearly insoluble in alcohol, chloroform, ether; solutions incompatible with alkalies, alkali earths, alkali carbonates, and the presence of hydrochloric acid beyond .5 p. c. inhibits its proteolytic activity, as do alcohol, and heat (70° C.; 159° F.); precipitated from solutions by

tannic or gallic acid, and by salts of many heavy metals, incompatible with pancreatin, this in neutral or alkaline solution destroying pepsin, while in acid media being destroyed by the pepsin. It digests at least 3000 times its own weight of freshly coagulated and disintegrated egg albumen—converts nitrogenous food (proteins—albumen, casein, fibrin, muscle) into albumoses and finally into soluble peptones; acts only in acid media, but when acid solutions are heated to 100° C. (212° F.) they lose all proteolytic power, becoming milky or with light flocculent precipitate; if in dry state not injured by above heat. When of a higher digestive power it may be reduced to the standard with pepsin of a lower digestive strength or lactose. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Glyceritum Pepsini, N.F.,* 8.75 p. c., + acid. hydrochlor. dil. $\frac{1}{5}$ p. c., glycerin 50, aq. dest. q. s. 100. Dose, ℥ss–1 (2–4 cc.).

Preps.: 1. *Elixir Pepsini, N.F.,* 1.75 p. c.—glycer. pepsin. 20, glycerin 10, acid. hydrochlor. dil. $\frac{2}{5}$, elix. arom. q. s. 100. 2. *Liquor Pepsini, N.F.,* glycer. pepsin. 5 p. c., acid. hydrochlor. dil. $\frac{1}{2}$ p. c., glycerin 31.5, aq. dest. q. s. 100. Dose, each, ℥j–2 (4–8 cc.).

2. *Elixir Pepsini Compositum.* Compound Digestive Elixir, *N.F.,* 1.75 p. c. 3. *Elixir Pepsini et Bismuthi, N.F.,* .875 p. c., + glycer. bism. 12.5, glycerin 12.5, +. 4. *Elixir Pepsini, Bismuthi et Strychninæ, N.F.,* strychnine .0175 p. c., acid. tart. .0175, elix. pepsin. et bism. q. s. 100. 5. *Elixir Pepsini et Rennini Compositum, N.F.,* 2.25 p. c., + rennin 1.75, acid. lact. $\frac{1}{5}$ p. c. 6. *Liquor Pepsini Antisepticus, N.F.,* 5 p. c., + acid. hydrochlor. dil. $\frac{1}{2}$ p. c. 7. *Liquor Pepsini Aromaticus, N.F.,* 1.75 p. c., + acid. hydrochlor. dil. $\frac{1}{2}$ p. c. Dose, each, ℥j–2 (4–8 cc.). 8. *Pepsinum Saccharatum, N.F.,* 10 p. c., + lactose 90. Dose, gr. 15–30 (1–2 Gm.).

PROPERTIES AND USES.—As a ferment to assist gastric digestion in persons having deficient secretion of gastric juice, in old persons during convalescence from long illness, cancer of stomach, diarrhea, diabetes; does not aid digestion of fats or carbohydrates. Should be given after meals, and followed half-hour afterward by dose of hydrochloric acid.

Derivative Product:

1. *Insulin.*—Since the investigations of Brown-Sequard, more than a generation ago, as to the therapeutic possibilities of secretions and extracts of animal organs, there has been much experimentation with some definite results. It is now believed that not a few of these glandular organs having internal secretion (hence names endocrines—Gr. ἔνδον, within, + κρίνειν, to separate—secreting internally, organotherapy, apotherapy) function directly into the blood and contribute, each its characteristic part, in preserving normal health, and that, where this part played has been determined in each case, by experimentation and observation, together with the resulting maladies from interrupted functioning, the clinician is aided in diagnosing the cause and remedy —specific secretion, similar in kind, from an outside animal. Although

PACHYDERMATA

the Pharmacopœia recognizes secretions of the suprarenal gland, thyroid gland, pituitary body, and pancreas, there are others of medical importance: *mammary gland*—dysmenorrhea, menorrhagia; *thymus gland*—exophthalmic goiter, rickets; *parotid gland*—dysmenorrhea, ovarian neuralgia; *parathyroid bodies*—paralysis agitans, tetanus; *cerebrum*—epilepsy, insanity, rabies, tetanus; *kidneys*—nephritis, uremia; *liver*—diabetes, hemeralopia; *ovaries* (*corpus luteum*)—neurasthenia, pregnant disturbance; *spleen*—anemia, malaria; *testicles*—arteriosclerosis, diabetes, locomotor ataxia, neurasthenia, chronics, etc. It has been known for years that glycosuria (sugar in the urine) and diabetic symptoms were due to defective internal secretion of the pancreas, but not until 1922 that the islands of Langerhans (collection of cells in the interstitial tissue of the pancreas believed to be independent ductless glands furnishing an internal secretion) was the part controlling the storage and disposition of sugar, and that when these islands were destroyed glucose appeared in the urine. Banting and Best have isolated from these islands this new remedy, insulin, which has a remarkable influence upon the quantity of sugar in the blood, producing a condition in which the blood sugar can be utilized, resulting in a perfect combustion of fats. This faulty functioning of the islands of Langerhans, resulting in *diabetes mellitus*, implies a continuous use of insulin, as thyroid in hypothyroidism, wherein its excess may lead to acidosis—weakness, fatigue, hunger, restlessness always, however, relieved by restoring glucose, levulose, orange juice, epinephrine. As with pancreatin and pepsin there are several methods of extracting insulin—with acidified water, acidified alcohol, using sodium chloride or ammonium sulphate, ether, etc., but only that of Best may briefly be outlined: Macerate, for several hours, finely ground, fresh prepared pancreas in equal weight of alcohol, strain, filter, add 2 vols. alcohol, let stand several hours, reclaim alcohol under pressure, 20°, to small volume, shake out twice with ether to remove lipoids, again reclaim to pasty mass under pressure, add 80 p. c. alcohol, centrifuge, remove clear top layer with pipette, dilute with several vols. alcohol, collect precipitate (crude insulin) on filter, dissolve in distilled water and put solution in ampuls. Each pound of pancreas yields about 5 grains of insulin, over one-half inorganic salts (chlorides, sulphates). The active hormone is best precipitated by picric acid, then hydrochloric acid added, with final precipitation by ether; yield of hydrochloride is 6 p. c. of crude insulin and 10 times stronger. It is a colorless, non-hygroscopic powder, not a pure chemical compound but a protein, injured by heat, destroyed by trypsin, or pepsin, and more stable in acid than alkaline solutions; it is measured in units, a unit being: least amount required to reduce blood sugar to .045 p. c. of a 2 Kg. rabbit which has fasted 24 hours. Must give amount which permits maintenance of normal blood sugar, .08 p. c., on a sufficient nutritive diet. A unit metabolizes about 1.5 Gm. sugar, and a patient voiding daily 40 Gm. sugar requires 29 units of insulin. Diabetes, diabetic coma, acidosis, pregnant vomit, infections, etc. Dose—5 units (hypoder-

mically, inert by the mouth) 3 times a day, half an hour before meals; ampuls 5 cc., containing 10 or 20 units in each cc.—50–100 units, each. *Synthalin* (synthetic insulin—derivative of guanidin), 1927; less powerful but a valuable auxiliary to insulin, as it may be administered by the mouth, and thereby replace two-thirds of the insulin injections—must adjust doses with caution. *Myrtillin,* 1927, harmless, reduces (by mouth) blood sugar quickly in diebetics needing immediate surgery.

7. RUMINANTIA. Ruminant Order (Family).

Ru-mi-nan′shi-a. L. fr. *ruminan(t)s,* ruminating, chewing the cud. All animals of this order (family—bos, camel, deer, neat cattle, sheep, etc.) are hoofed quadrupeds, cloven-footed, even-toed, with 4 stomachs, or 1 with 4 divisions. Food being slightly masticated goes to No. 1 stomach, where it is ground finer; now passes to No. 2, where it is formed into balls, which are returned to the mouth and chewed again, constituting the cud; thence the food passes to Nos. 3 and 4 stomachs, where it is digested and assimilated.

Genera: **1. Ovis. 2. Bos.**

OVIS ARIES. THE SHEEP.

1. Sevum Præparatum. Prepared Suet, *U.S.P.*
2. Adeps Lanæ. Wool Fat, *U.S.P.*

Ovis aries, *Linné.* { 1. The internal fat of the abdomen of the sheep, purified by melting and straining. 2. The purified, anhydrous, fat-like substance from the wool of sheep.

Habitat. Domesticated, and form a variety from either the Siberian (*Ovis Ammon*) or S. European sheep (*Ovis Musimom*).

Syn. 1. Sev. Præp., Mutton Suet, Sevum; Fr. Suif (Graisse) de Mouton Purifié; Ger. Sebum ovile (ovillum), Hammeltalg, Talg. 2. Adeps Lan., Anhydrous Lanolin, Lanolinum, Lanolin (L. *lana,* wool, + *oleum,* oil, + *in*), Agnin, Oesipus, Oesipum, Woolfat; Fr. Suint de Laine; Ger. Woolfett, Adeps Lanæ anhydricus, Wollfett.

O′vis. L. sheep, fr. Gr. ὄις, a sheep, from which comes our ewe—*i. e.,* original name.

A′ri-es. L. a ram. fr. OE. *ares—i. e.,* the original name for the male species.

Animal.—This is one of the most useful animals to man. The male is a ram, the female an ewe, and the young a lamb; the flesh of the latter is called lamb, that of the adult mutton; the fleece is wool, the principal component of our warm clothing; the prepared hide is the useful sheepskin; the entrails furnish sausage skins, and when dried (catgut) are twisted into musical instrument strings; in addition to these we have the above two official products. There are many varieties of sheep, but the most important are: 1, Leicester; 2, Cotswold; 3, Southdown; 4, Cheviot; 5, Astrakhan; 6, Cretan; 7, Merino.

I. Prepared Suet: This is taken chiefly from around the kidneys, and is prepared by freeing from adhering membrane and blood, cutting into pieces, melting carefully, and straining through cotton or flannel;

may also boil it in water, when it rises to the surface, leaving the water and impurities as substrata. It is a white, solid fat, when fresh a slight characteristic odor and a bland taste, rancid on prolonged exposure to air, insoluble in water, cold alcohol, soluble in boiling alcohol (45), ether (60), slowly in purified petroleum benzin (2), from which, on standing, it slowly separates in crystalline form; alcoholic solution neutral, slightly acid to litmus paper moistened with alcohol; melts at 47° C. (117° F.), congeals at 39° C. (102° F.). *Impurities:* Free acid, etc. Should be kept in well-closed vessels impervious to fat, and not used when rancid.

CONSTITUENTS.—Stearin and palmitin 70 p. c., olein 30 p. c., hircin a trace.

PREPARATIONS.—1. *Unguentum Hydrargyri Fortius*, 23 p. c.

Prep.: 1. *Unguentum Hydrargyri Mite*, 13.8 p. c.

2. *Ceratum Resinæ Compositum, N.F.*, 30 p. c. 3. *Sevum Benzoinatum, N.F.*, 3 p. c. (benzoin), prepared suet 100, melt, heat for 1 hour at 50° C. (122° F.), strain, stir until cold:

Preps.: 1. *Mulla Acidi Salicylici, N.F.*, 80 p. c. 2. *Mulla Creosoti Salicylata, N.F.*, 65 p. c. 3. *Mulla Hydrargyri Chloridi Corrosivi, N.F.*, 90 p. c. 4. *Mulla Zinci, N.F.*, 70 p. c.

4. *Unguentum Fuscum, N.F.*, 25 p. c.

PROPERTIES AND USES.—Lenitive, when rancid an irritant; chiefly in cerates, ointments, plaster, as it is thicker than lard, for dressing blisters, excoriated surfaces, chapped hands, etc.

Allied Fat:

1. *Sevum Bovinum, Beef Tallow.*—This is the internal fat of *Bos taurus;* it is similar to the preceding, except that it has a slightly different odor; melts at 40° C. (104° F.), and contains more palmitin, and no hircin.

II. WOOL FAT: Sheep's wool contains much fat, usually 45 p. c. of its weight, which must be removed before the wool is suitable for fabrics. This is accomplished by macerating the wool in several waters, preferable boiling, collecting of each the supernatant fat layer, mixing them, straining through linen, exposing to sun until bleached white; sea-water may be employed, skimming off foam and kneading it with hands in the sun; it may be purified by treating with weak alkali solutions, centrifuging the resulting emulsion, thereby separating a lower aqueous layer (soap solution of impure fatty acids) and an upper creamy layer (cholesterin, fats), which upon removal and treatment with calcium chloride, separating and dehydrating the fat by fusing with unslaked lime, extracting mixture with acetone, and reclaiming same, yields a residue of pure wool fat. It is a brownish-yellow, tenacious, unctuous mass; slight odor; insoluble in, but miscible with water (2), sparingly soluble in alcohol, more so in hot alcohol, soluble in ether, chloroform; melts at 40° C. (104° F.); vaporizes at higher temperatures, the vapor burning with luminous, sooty flame. *Tests:* 1. Dissolve 2 Gm. in 10 cc. ether, add 2 drops of phenolphthalein T. S.—liquid

not red (abs. of free alkalies, but + .2 cc. + $\frac{N}{10}$ sodium hydroxide—deep red color (abs. of free fatty acids). 2. .5 Gm. completely soluble in boiling dehydrated alcohol 40 cc. (abs. of petrolatum); dry to constant weight—loses .5 p. c. of weight (abs. of water). 3. Incinerate—ash .1 p. c., which is not alkaline to litmus (abs. of alkalies, soaps). *Impurities:* Alkalies (free), soaps, free fatty acids, chlorides, glycerin, water, petrolatum, soluble oxidizable substances. Should be kept cool, in well-closed containers impervious to fat.

CONSTITUENTS.—Cholesterin, $C_{26}H_{43}OH$, isocholesterin, cerylic, carnaubic, lanolinic, and other alcohols, esters of lanopalmitic, myristic, carnaubic, oleic, and other acids, ash .3 p. c.

PREPARATIONS.—1. *Adeps Lanæ Hydrosus.* Hydrous Wool Fat. (Syn., Adeps Lan. Hyd., Lanolin, Lanolinum; Fr. Lanoléine, Graisse de Laine Hydratée; Ger. Adeps Lanæ cum Aqua, Wasserhaltiges Wollfett.)

Manufacture: Place in a warm mortar wool fat 70 Gm., add gradually with constant stirring, water 30 cc. It is a yellowish-white, nearly white, ointment-like mass; slight odor; insoluble in, but miscible with water (2); with ether, chloroform—turbid, neutral solutions; contains 25–30 p. c. of water. *Test:* 1. When heated separates into upper oily and lower aqueous layer; heated on water-bath with stirring—residue 70–75 p. c., which is transparent when melted and on cooling remains a yellowish, tenacious, unctuous mass, soluble in ether, chloroform, sparingly in alcohol, and responds to tests of wool fat. Should be kept cool, in well-closed containers impervious to fat.

Preps.: 1. *Unguentum Chrysarobini,* 94 p. c. 2. *Unguentum Hydrargyri Ammoniati,* 40 p. c. 3. *Unguentum Hydrargyri Oxidi Flavi,* 10 p. c. 4. *Unguentum Hydrargyri Oxidi Rubri, N.F.,* 40 p. c. 5. *Unguentum Stramonii, N.F.,* 20 p. c.

2. *Unguentum Belladonnæ,* 30 p. c. 3. *Unguentum Iodi,* 80 p. c. 4. *Unguentum Iodoformi,* 20 p. c. 5. *Unguentum Resorcinolis Compositum, N.F.,* 28 p. c.

Unoff. Preps.: Ceratum Plumbi Subacetatis, 20 p. c. *Unguentum Lanæ Compositum* (Br.), 40 p. c.

PROPERTIES AND USES.—Lenitive. It is claimed to be absorbed by the skin more quickly than most fats, hence an excellent base for mercury and other medicines to be administered by inunction. Soothing to the skin and a good base for ointments, as it does not become rancid.

Derivative Products:

1. **Epinephrina. Epinephrine,** $C_9H_{13}O_3N$, *U.S.P.*—(Syn., Epineph., Lævo-methylamino-ethanol-catechol, Adnephrin, Adrin, Suprarenalin, Supracapsulin; Br. Adrenolinum; Fr. Adrénaline; Ger. Suprarenin, Epirenan). The active constituent of the suprarenal glands of animals used for food by man (sheep, ox, pig), or made synthetically. The suprarenal or adrenal gland (body or capsule) of the sheep (ox, pig) is a small glandular, follicular body shaped like a cocked hat, and perched as a cap on the top of each kidney. The gland is not confined

to the animals above mentioned, but is present in mammals and most other vertebrates, that in man being 2.5–5 Cm. (1–2′) long, less in width, and 6 Mm. (¼′) thick; it consists of an outer yellowish cortical portion and a very dark inner medullary portion (medulla), and while ductless and of unknown function contains abundant bloodvessels, nerves, and lymphatics; it yields its active constituent to boiling water, or to a more or less saturated aqueous solution of boric acid, in which the medicinal properties may remain unimpaired for months.

Manufacture: Epinephrine—by several processes, both from the glands and synthetically, that of Takamine being the original: Steep comminuted capsules twice, 5 hours each time, in acidulated water, mix the two liquids, partially evaporate *in vacuo*, add 2–3 volumes alcohol (to precipitate inert substances), reclaim most of alcohol, add ammonia, which precipitates impure yellowish-brown epinephrine, that may be purified by redissolving and crystallizing. It is a white, light brownish, microcrystalline, odorless powder, gradually darkening on exposure to air; slightly soluble in water, alcohol, insoluble in ether, chloroform, acetone, fixed or volatile oils. *Tests:* 1. Combines with acids to form salts which are readily soluble in water, and from these solutions the base may be precipitated by ammonia or alkali carbonates. 2. Acid solution + solutions of trinitrophenol, tannic acid, phosphomolybdic, mercuric potassium iodide, or platinic chloride—no effect; saturated aqueous solution slightly alkaline; ash from .1 Gm.—negligible. 3. Aqueous solution (1 in 1000), slightly acid, + ferric chloride T. S.—emerald-green color, then cherry-red, brown; other oxidizing agents—red, pink, or violet, changing to brown. It is very sensitive chemically, being destroyed by formaldehyde, oxidizing agents, alkalies, free halogens, and salts of easily reducible metals (iron, etc.), and injured by light, heat, and air; reducing agents, sulphites, etc., have a preservative effect. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{300}$–$\frac{1}{100}$ (.002–.0006 Gm.).

Preparation.—1. *Liquor Epinephrinæ Hydrochloridi.* Solution of Epinephrine Hydrochloride. (Syn., Liq. Epineph. Hydrochlor.; Br. Liquor Adrenalini Hydrochloricus, Hydrochloric Solution of Adrenalin; Solution of Adrenalin Hydrochloride.) An aqueous solution with hydrochloric acid q. s.—.095–.105 Gm. (1.5 gr.) in each 100 cc. (1550 ♏.)—practically 1 in 1000. Dose, ♏v–15 (.3–1 cc.), intravenously or intramuscularly—inert by mouth, nearly so hypodermically; solution (1) + physiological sodium chloride solution (99) valuable intravenous solution causing a rise in systolic blood-pressure of the dog; may use weaker solution (1 in 10,000); suprarenal gland, gr. 3–15 (.2–1 Gm.); extract, gr. 1–3 (.06–.2 Gm.).

Properties.—Astringent, hemostatic, cardiac stimulant, vascular constrictor, muscle tonic, local anesthetic, poisonous; checks local congestion, local hemorrhage, stimulates circulation, relieves asthmatic paroxysms, contracts uterus. Some claim a function for the gland—the removal and destruction of certain poisons from the blood, or the

production of an active substance necessary for the maintenance of health; slows pulse, causing it to become strong and regular when weak or intermittent, stimulates feeble cardiac muscle—force in the systole, as digitalis; no action on normal heart, while no organic disease contraindicates its use, increases blood sugar, reduces size of thyroid. Epinephrine is considered about 600 times stronger than extract of the glands, and a solution of its chloride (1 in 10,000) blanches normal conjunctiva within 30–60 seconds.

Uses.—Conjunctivitis, rhinitis, hay fever, chronic inflammation, hemorrhage, surgical shock, collapse, asthma, keratitis, iritis, ear affections, relieves deafness and tinnitus, hypertrophy of turbinated bodies (increases effect of cocaine), Addison's disease (characterized by fibro-caseous metamorphosis of suprarenal capsules, brownish-olive coloration of skin, anemia, prostration), asthma, epistaxis, rickets, exophthalmic goiter, diabetes, enlargement of spleen and liver, local vaso-constrictor in minor surgery.

2. **Thyroideum. Thyroid,** *U.S.P.* — (Syn., Thyroideum Siccum, U.S.P. 1910; Br. Thyroideum Siccum, Dry Thyroid, Ger. Glandulæ Thyreoideæ siccatæ, Getrocknete Schilddrüsen.) The cleaned, dried, and powdered thyroid gland of animals used for food by man (sheep, ox, pig) previously deprived of connective tissue and fat, and containing .17–.23 p. c. of iodine in thyroid combination.

Manufacture: Remove external fat and connective tissue from thyroid glands taken from sheep (ox, pig) immediately after killing, cut glands across, rejecting those that are hypertrophied or contain cysts or otherwise abnormal; mince finely the healthy glands, dry at 32–38° C. (90–100° F.), powder dried product, remove all fat by treating with petroleum benzin, dry residue. It is a yellowish, amorphous powder, slight, characteristic odor; must be free from iodine in inorganic or any other form of combination than that peculiar to the thyroid gland; contains thyroxin, thyroiodine (iodothyrine ?), not more than 6 p. c. of moisture; ash 5 p. c.; 1 part corresponds to 5 parts of the fresh glands. Dose, gr. 5–10 (.3–.6 Gm.); *Extractum Thyroidei* is made with glycerin (4 glands in each ounce; 30 cc., the solution heated with strong phosphoric acid, then poured into lime water, precipitate dried. *Liquor Thyroidei,* Br., made with glycerin, preserved with .5 p. c. aqueous solution of phenol, is pinkish, turbid, without putrescent odor; 100 minims (6 cc.) represent one gland, ♏v–15 (.3–1 cc.).

Commercial.—The thyroid gland is found in front of the neck (tracheæ) of all mammals, that of the sheep being near the first two tracheal rings and consisting of 2 oval lobes joined by a narrow band (isthmus), brownish-red, weighing about 2 drams (8 Gm.), that of man being 4–5 times larger.

Thyroxinum, Thyroxin, Thyrox., $[(C_3H_5ONI_3).C_2H_4COOH]$, *U.S.P.*— This active principle from the thyroid gland, containing not less than 63 p. c. of iodine, is obtained by treating fresh or desiccated glands with hot aqueous 5 p. c. solution of sodium hydroxide, cooling filtrate,

acidifying, redissolving slight precipitate in sodium hydroxide solution, precipitating with hydrochloric acid, drying precipitate, dissolving in alcohol, neutralizing, treating filtrate with saturated aqueous solution of barium hydroxide, filtering, removing barium by carbon dioxide, reclaiming alcohol, acidifying residue, dissolving precipitate in weak sodium hydroxide solution in alcohol, treating with carbon dioxide, reclaiming alcohol, from residue upon standing, the mono-sodium salt of thyroxin separates, which may be further purified; yield being 1 ounce from 3 tons of fresh thyroids. It occurs in white, slightly yellow, needle-like, odorless, crystals or powder, insoluble in water, alcohol, or other usual organic solvents; soluble in presence of mineral acids, in alcohol, also in solutions of alkali hydroxides, and when alkaline solutions are saturated with sodium chloride—sodium salt of thyroxine separates. *Tests:* 1. Ignite few Mg. with .1 Gm. sodium carbonate, dissolve residue in 2 cc. distilled water, acidulate with acetic acid, + 1 cc. chloroform and few drops chlorine T. S.—chloroform acquires violet color; ash from .01 Gm.—negligible . 2. Dry .02 Gm. 24 hours over sulphuric acid—loss negligible (abs. of water). *Impurities:* Soluble iodides, water, etc. Dose, gr. $_2\frac{1}{4}\text{0}$—$\frac{1}{6}\text{0}$ (.00025–.001 Gm.). *Thyreoidictin* (Capsulæ Antithyroideæ) is a reddish-brown powder from blood of thyreoidectomized sheep (those with thyroid gland removed) may be used similar to official products.

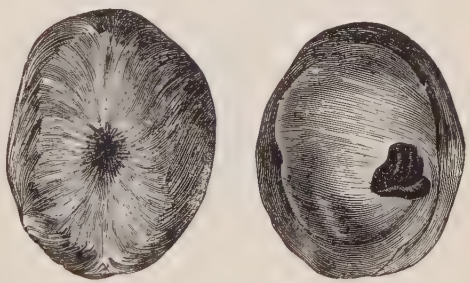
Properties and Uses.—The thyroid gland is one of the organs (Endocrines) that furnish internal secretion necessary for health, congenital absence leading to cretinism—lack of bony ossification, mental and physical development, general inertia; its removal produces myxedema—dropsy, slow pulse, subnormal temperature, atrophy, thick, dry skin, loss of hair, obesity, craving for sweets. Both thyroid and thyroxin influence the processes of nutrition and metabolism—not quite understood; in health they are a circulatory sedative (depressant), causing loss of flesh when persisted in—producing ill-health, wrinkled and changed skin from healthy to a sallow hue; obesity, antifat nostrums, metrorrhagia, arthritis, asthma, hay fever, dementia, acute mania, exophthalmic goiter. When taking full doses patient should remain in bed, owing to attending depression, which may be abated somewhat by strychnine; causes not only loss of fat, but also nitrogenous tissue, hence persons must partake liberally of protein diet.

Allied Animals:

1. *Mos'chus moschif'erus, Moschus, Musk*, U.S.P. 1820–1910.—The dried secretion from the preputial follicles; C. Asia –Siberia, Thibet, Himalayas, pine forests, great altitudes. The musk deer, resembling our deer, is about 1 M. (3°) long, .6 M. (2°) high, haunches higher than shoulders, without horns, but with a canine tooth (tusk) from upper jaw, on either side, projecting downward 2 inches, curved backward; hair iron-gray, blackish; timid, fleet-footed, hiding in day, foraging at night, and while numerous, through their intelligence only a few (20,000 annually) are trapped, snared or shot. They are hunted for

hides, the male additionally for the secretion (musk) found in a small projecting hairy sac, between the umbilicus and prepuce. As soon as killed the sac is cut off, dried on heated stones and marketed, each adult sac yielding 2–6 drams (8–24 Gm.) of chocolate-brown, thick liquid secretion that finally by evaporation becomes the commercial granulated musk, which occurs in small, irregular granules, 1–2 Mm. ($\frac{1}{25}$–$\frac{1}{12}$′) thick, blackish with a few brown fragments, glistening, somewhat oily; peculiar, powerful, persistent odor, somewhat bitter taste; solvents: diluted alcohol, ether, hot water partially; contains volatile oil .5–2 p. c., ammonia, an acid, cholesterin, fat, wax, albumin, ash 8 p. c.; odor may be due to a continuous decomposition of one of the constituents in the presence of moisture. There are four varieties: 1, Tonquin (Thibet, Chinese—Sze-Chuen province), best, shipped 25 sacs in lead-lined boxes; 2, Siberian (Russian, Cabardine), little weaker and with ammoniacal odor; 3, Bucharian (Assam), smaller sacs, rarely reaching our market; 4, Canton (Tonquinol, Bauer, Artificial)—trinitro-isobutyl-methyl-benzol, obtained by heating nitric

Fig. 442.—Musk deer.



a *b*

Fig. 443.—Chinese musk sac; *a*, lower surface; *b*, upper surface.

and sulphuric acids with tertiary butyltoluene, or by treating rectified oil of amber with fuming nitric acid. *Adulteration:* Very common, owing to its high cost: Artificial sacs filled with dried blood, resin, lead, sand, wax, storax, benzoin, starch, asphaltum artificial musk; natural sacs with more or less abstraction, being replaced by some of the above substances. Antispasmodic, nervine, anodyne, diffusible stimulant—similar to valerian, asafetida, camphor, ammonia; typhoid, typhus and eruptive fevers, pneumonia, infantile convulsions, hiccough, croup, pharyngeal spasms, whooping-cough, hysterical convulsions, delirium tremens. Dose, gr. 1–10 (.06–.6 Gm.); Tincture, 5 p. c. (diluted alcohol), ʒss–2 (2–8 cc.); Pill, Emulsion.

2. *Cas'tor Fi'ber, Castoreum, Castor, Beaver.*—Rodentia. The dried preputial follicles, and their secretion, obtained from the male and female animal, separated from the frequently attached shorter and smaller oil sacs, U.S.P. 1820–1870; Canada, Russia, Beaver is about .6–.8 M. (2–2½°) long; tail 25–30 Cm. (10–12′) long, 7.5–10 Cm. (3–4′) wide, flattened, hairy at base, scaly at end; head like a rat's; has no

canines, but 2 incisors, 4 molars all around for gnawing; hair brownish. The American or Canadian is smaller, with darker fur, follicles weigh 1–4 ounces (.03–.12 Kg.), and are mostly used. Russian or Siberian has follicles pyriform, 2–8 ounces (.06–.24 Kg.); odor more agreeable, 7.5 Cm. (3′) long, club-shaped, in pairs, wrinkled, brown; contents brown, hard, friable. Alcohol dissolves one-half, giving brown tincture, turbid on adding water, clarified by ammonia; contains volatile oil, having phenol 1–2 p. c., resinous substance (bitter) 14–58 p. c., castorin, salicin, osmazone, urates, benzoates, cholesterin, ash 3.5 p. c. Used as stimulant, antispasmodic, emmenagogue, for hysteria, fevers, epilepsy, typhoid, amenorrhea; in decoction, tincture. Dose, gr. 10–30 (.6–2 Gm.). It is weaker than musk, and presents no advantage over valerian, camphor, ammonia, ether, etc. It is adulterated with blood, resins, minerals, calcium carbonate, goat scrotums, etc., sometimes to 50 p. c. The oil-sacs furnish our once official *Axungia Castoris.*

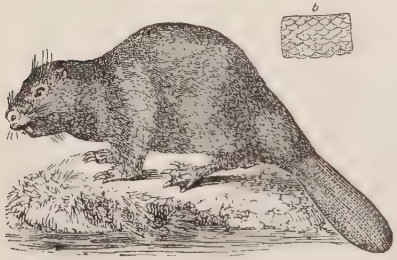


FIG. 444.—*Castor Fiber: b*, scales of the tail.

FIG. 445.—Castor follicles: one-fourth natural size.

3. *Cer'vus El'aphus, Cornu Cervi, Stag's Horn, Hart's Horn.*—The horn of the stag, a species of deer, U.S.P. 1820–1830. The hard, bony horns yield by boiling with water a transparent, colorless, inodorous jelly, and then incineration (of cleaned bones) gives pure calcium phosphate, which was mixed with antimony sulphuret and subjected to white heat, yielding antimony oxide and calcium phosphate; as such was a component of our (once official) first-made antimonial or James' powder.

4. *Antil'ope Dor'cas.*—N. Africa. Deer-like, ruminant animal, whose globular excrements have strong musk-odor, for which it is used in perfumery. *Hy'rax capen'sis, Hyraceum*, S. Africa. The dry excrements of the badger or klipdas, a mammal .5 M. (18′) long, black. When hot has castor oil odor; partly soluble in water, less so in alcohol, ether.

5. *Civet'ta* and *Zib'ethum, Civet.*—Animal .6–1 M. (2–3°) long, .3 M. (1°) high, unctuous secretion in the pouch between anus and genitals of both sexes of *Viver'ra Civet'ta* and *V. Zib'etha*, Africa, S. Asia. These are grown for secretions, which are removed by ladles; it is at first yellow, then dark brown. Like musk medicinally, but mostly used in perfumery.

BOS TAURUS. THE OX AND COW.

1. Fel Bovis. Oxgall, *U.S.P.*
2. Lactosum. Lactose, *U.S.P.*

Bos taurus, *Linné.* { 1. The fresh bile of the ox. 2. A sugar, $C_{12}H_{22}O_{11}.H_2O$, obtained from cow's milk.

Habitat. Domesticated; universal.

Syn. 1. Fel Tauri, Fel Bovinum, Bilis Bubula, Ox-bile; Fr. Bile (Fiel) de Bœuf; Ger. Ochsengalle, Rindsgalle. 2. Lactos., Saccharum Lactis, U.S.P. 1910, Milk Sugar, Sugar of Milk; Fr. Sucre de Lait, Lactine; Ger. Milchzucker.

Bos. L. *bos, bovis,* fr. Gr. *βοῦς,* an ox—*i. e.,* its classic name.

Tau'rus. L. fr. Gr. *ταῦρος,* a bull, ox—*i. e.,* its classic name.

Animal.—Large, 2–3 M. (6–10°) long, 1–1.6 M. (3–5°) high, head low upon a short neck, legs relatively short, hoofs broad, muffle naked, horns unbranched, tail tufted at the tip, inguinal teats.

I. Bile (oxgall): This is separated by the liver in the gall-bladder; it is a brownish-green, somewhat viscid liquid, characteristic odor, disagreeable, bitter taste, sp. gr. 1.020, neutral, faintly alkaline. *Tests:* 1. Add alcohol—precipitate (mucilaginous matter), filter, evaporate off alcohol, when it resists putrefaction; shake with water—frothy mixture. 2. Mix 2 drops with water 10 cc., + a drop of a fresh solution of sucrose 1 and water 4, + sulphuric acid cautiously added until precipitate first formed is redissolved—brownish-red color, changing to carmine, purple, violet. Dose, inspissated bile, gr. 5–15 (.3–1 Gm.).

Constituents.—Water 85–90 p. c., solids 10 p. c.: Sodium and potassium glycocholates and taurocholates 6 p. c. (boiled with alkalies glycocholic acid splits into cholic acid and glycocoll, and taurocholic acid into cholic acid and taurin, $C_2H_7NSO_3$); bile pigments—bilirubin (orange-red), $C_{32}H_{36}O_6N_4$, oxidizing quickly into biliverdin (dark green), $C_{32}H_{36}O_9N_4$, bilifuscin (dark brown), biliprasin (greenish-black), bilihumin (blackish), bilicyanin (bluish), mucilage (precipitated by 2 vols. alcohol), cholesterin, $C_{26}H_{44}O$, choline, fat, albumin, soap, mucin, urea, salts.

Preparation.—1. *Extractum Fellis Bovis.* Extract of Oxgall. (Syn., Ext. Fel. Bov., Powdered Extract of Oxgall; Fr. Extrait Bile (Fiel) de Bœuf; Ger. Ochsengallextrakt.)

Manufacture: Macerate for 2 days 80 Gm. with alcohol 100 cc., decant liquid, wash residue with alcohol 50 cc., decant liquid, mix and filter the two liquids, reclaim alcohol, evaporate at 75–80° C. (167–176° F.) to thick extract, spread on glass plates, expose to warm air at 70° C. (158° F.) until dry, pulverize, add dried starch q. s. 10 Gm.; mix thoroughly, pass through fine sieve; avoid copper utensils; 1 Gm. represents 8 Gm. of oxgall. Should be kept in small, wide-mouthed, tightly-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

RUMINANTIA

Unoff. Prep.: Fel Bovis Purificatum, U.S.P. 1900; evaporate oxgall 300 to 100, add alcohol 100, mix thoroughly, after 3–4 days decant, filter, distil off alcohol, evaporate to pilular consistence, dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Tonic, laxative, cholagogue, antiseptic, vermifuge; constipation, especially when feces pale color, dyspepsia, jaundice; whenever biliary secretion is deficient; locally in glandular enlargements.

II. Lactose (Milk Sugar): This is found only in mammal's milk, usually to the extent of about 5 p. c.; obtained mostly in Switzerland, Bavaria, etc., from whey of cheese-making; the butter and casein are removed, the latter by allowing time for oxidation and generation of lactic acid, or by adding to skimmed milk diluted sulphuric acid, evaporating the resulting whey to $\frac{1}{15}$ original bulk, when it is a brown, viscid, sweetly saline mass; this is put into large tanks or tubs, and in 1–2 days lactose crystallizes in bright yellow granules—*sugar sand*—the process being facilitated by the presence of thin sticks or cords; the impure crystals may be dissolved in water, decolorized by charcoal and recrystallized. It is in white, hard, crystalline masses or white powder, producing grittiness on the tongue, odorless, faintly sweet taste, permanent, readily absorbs odors, soluble in water (4.9), boiling water (2.6), insoluble in chloroform, ether, almost so in alcohol; aqueous solution (1 in 20) neutral, dextrorotatory. *Tests:* 1. Mix hot saturated aqueous solution and sodium hydroxide T. S., each 5 cc., warm gently—liquid yellow, finally brownish-red; add few drops of cupric sulphate T. S.—precipitates (cuprous oxide). 2. Dissolve 3 Gm. in boiling distilled water 10 cc.—solution odorless, clear, colorless; incinerate—ash .1 p. c. *Impurities:* Heavy metals, sucrose or glucose—25 50 p. c.), dextrin, starch. Should be kept in tightly-closed containers. Dose, ʒj–5 (30–150 Gm.) + per die, in powder, syrup.

Preparations.—1. *Ferri Carbonas Saccharatus*, 10 p. c. 2. *Pulvis Ipecacuanhæ et Opii*, 80 p. c. 3. *Triturationes*, 90 p. c. 4. *Pepsinum Saccharatum, N.F.*, 90 p. c.

Properties and Uses.—Diuretic in cardiac dropsy; as a diet in consumption and other wasting diseases. In pharmacy for triturations, powders, etc., for diluent, as it is much harder than sucrose, hence aids in comminuting medicines more finely; it is less sweet than sucrose, and not so apt to ferment in the stomach or bowels, hence suitable for infant foods, certain forms of dyspepsia, etc.

Derivative Products:

1. *Extractum Carnis, Extract of Beef, Beef Extract, N.F.*—The residue obtained from fresh beef broth by evaporation at a low temperature—grind lean beef to a pulpy mass, stir with equal quantity of water; strain, evaporate in steam-pans over which a current of air is passed continuously, filter, evaporate to desired consistence. It is a yellowish-brown, dark brown, slightly acid, pasty mass, agreeable meat-like odor

and taste; 25 Gm. diluted to 250 cc. with distilled water—clear solution without sediment, boil 10 cc. of this solution 1 minute with 1.5 Gm. of purified animal charcoal, replacing water of evaporation—1 drop of filtrate produces no blue coloration when added to 3 drops of diphenylamine solution (1 in 100) in concentrated sulphuric acid (abs. of nitrate); contains creatin, creatinin, carnin, carnic acid, xanthin; less nutritious than meat, as fat, albumin, much fibrin and gelatin are removed in the process of heating and cooling; 1. *Elixir Carnis et Ferri,* 3.5 p. c.—extract 3.5 Gm., ferr. et ammon. cit. .875, alcohol 20 cc., syrup 10, sp. aurant. co. ½, aq. dest. q. s. 100. Should be kept cool, in amber-colored bottles. Dose, ʒj–4 (4–15 cc.).

2. *Renninum, Rennin, N.F.*—The partially purified milk-curdling enzyme from glandular layer of the calf stomach (*Bos taurus*), capable of coagulating not less than 25,000 times its weight of fresh milk. May be obtained by digesting for a day fresh mucosa of the calf stomach in ½ p. c. sodium chloride solution, bringing up filtrate to 1 p. c. hydrochloric acid, saturating filtrate with sodium chloride, keeping at 37° C. (99° F.) for several days, when rennin, soluble in water, separates as white flocculi; then dry; or may macerate for 3 weeks finely minced fresh calf stomach, rejecting 3 inches of upper cardiac portion, in sherry wine, yielding rennet wine, of which ʒij will coagulate Oj of milk in 2 minutes. Rennin is a grayish-white, yellowish-white powder, or pale yellow grains, scales, characteristic, slightly saline taste, peculiar, not unpleasant odor; slightly hygroscopic; slowly soluble in water or diluted alcohol, solutions being somewhat opalescent; mounts in water or diluted alcohol—show no cellular structure, or + iodine T. S.—no blue coloration; rennin of higher coagulating power may be brought to the standard with sodium chloride and lactose; it deteriorates rapidly, and must be kept cool, in well-stoppered, amber-colored bottles.

Uses.—Preparing curds and whey—junket, thus: add ʒj (4 cc.) essence of pepsin containing rennin to a pint of milk; after several hours liquid becomes semi-solid, when it may be given invalids, or if the casein is not desired, break up coagulum and administer only the strained liquid which includes the more digestible albuminoids and milk salts; 1. *Elixir Pepsini et Rennini Compositum,* 1.75 p. c., dose, ʒj–2 (4–8 cc.).

Related Products:

1. **Gelatinum. Gelatin,** *U.S.P.*—(Syn., Gelat.; Fr. Gélatine; Ger. Gelatina alba, Weisser Leim.) A product obtained from animal tissues, as skins, ligaments and bones.

Manufacture: Gelatinous tissues, as skins, tendons, ligaments, bone-cartilage, bones, hoofs, horns, etc., previously cleansed by washing in cold water, or treatment with dilute alkali solution, are placed on a perforated diaphragm in a boiler, and boiled with water until the collagen becomes soluble, and solution stiffens to a jelly on cooling; while hot solution is deprived of fat, extraneous matter and impurities by

skimming, straining, etc.; when cold jelly is cut into cakes, which are dried on nettings. It is in sheets, flakes, shreds, coarse or fine powder, colorless, yellowish, slight characteristic odor and taste; unalterable in the air when dry, decomposing when moist or in solution; insoluble in cold water, but swells and softens in it, absorbing 5–10 times its own weight; soluble in hot water, acetic acid, glycerin; insoluble in alcohol, chloroform, ether, benzene, carbon disulphide, fixed or volatile oils. *Tests:* 1. Aqueous solution (1 in 5000), + tannic acid T. S.—at once turbid. 2. Hot aqueous solution (1 in 40) is without putrid odor, not more than slightly acid or opalescent in a stratum of 2 Cm. ($\frac{4}{5}'$) thickness, and on cooling and standing several hours forms a firm transparent or translucent jelly; incinerate .5 Gm.—ash 2 p. c., which dissolved, with heat, in slight excess of hydrochloric acid + few drops of nitric acid, + 25 cc. distilled water—meets requirement tests for heavy metals. *Impurities:* Heavy metals, arsenic, sulphur dioxide (that used in capsules containing not more than .15 p. c.).

Preparation.—1. *Gelatinum Glycerinatum.* Glycerinated Gelatin. (Syn., Gelat. Glycerin., Glycerin Jelly; Fr. Gelée Glycerinée; Ger. Glycerinleim.)

Manufacture: Cover over gelatin 100 Gm. with water, previously boiled and cooled, let stand 1 hour, discard water, drain and heat gelatin with glycerin 100 Gm., on water-bath until dissolved, strain and continue heat until product weighs 200 Gm.; when cold cut into pieces, preserve in well-closed containers.

Properties and Uses.—Hemostatic, aneurism, increases coagulability of the blood, when unable to control by pressure or ligature; acts locally and generally in aiding blood coagulation; may be applied to oozing capillaries in 10 p. c. solution, or internally by hypodermic injection, in 1–2 p. c., mixed with normal salt solution (.85 p. c.); care must always be used to avoid veins and to have the solution sterilized, thereby preventing embolus, infection, tetanus, etc.; court plaster, coating pills, disks, lozenges, suppositories, hard and soft capsules, detannating wines.

2. **Keratin, Ceratin.**—Resembles protein, but has some of its oxygen replaced by sulphur, being the chief constituent of cattle and horses' hoofs, feather quills, finger-nails, and epidermal surface. Obtained by macerating horny substances 36 hours in pepsin (1), diluted hydrochloric acid (15), water (1,000), to remove all matter soluble in gastric juice, digest at moderate heat the residue in 10 times its weight of 5 p. c. ammonia water until nearly dissolved, filter, evaporate. Occurs in thick scales, yellowish-gray, opaque, soluble in alkalies and strong acetic acid, insoluble in water, alcohol, ether, diluted acetic acid, and acidified pepsin solutions. Used in coating pills—such as are not intended to dissolve in the stomach, but in the duodenum—where concentrated drugs are desired for the intestines, or the use of those incompatible with pepsin and decomposed by stomach's secretions—metallic sulphides, tannin, pancreatin, etc.

3. **Antitoxinum Diphthericum. Diphtheria Antitoxin,** *U.S.P.*—(Syn., Antitox. Diph., Serum Antidiphthericum, U.S.P. 1910, Purified Antidiphtheric Serum, Concentrated (Refined) Diphtheria Antitoxin, Antidiphtheric Globulins; Fr. Sérum antidiphtherique; Ger. Diphtherie-(Heil)serum.)

Manufacture: It is an aqueous solution of certain antitoxic substances obtained from the blood serum or plasma of an animal of the genus *E'quus* (*E. cabal'lus*), which has been properly immunized against diphtheria toxin; after the serum or plasma from the immunized animal has been collected, the antitoxin-bearing globulins are separated from the other constituents of the serum or plasma (by adding ammonium sulphate) and dissolved in water; then sodium chloride and a preservative are added, solution filtered through a bacteria-excluding filter, that yields a potency of not less than 350 antitoxin units per cc. It is a transparent, or slightly opalescent liquid, sometimes with a slight granular deposit, of a faint brownish, yellowish, greenish color; nearly odorless, or slight odor of antiseptic used as a preservative. It must come from healthy animals, must be sterile, free from toxins, and must not contain an excess of preservative (not more than .5 p. c. of phenol, or .4 p. c. of cresol, when either used) and not more than 20 p. c. of total solids.

Commercial.—The diphtheria bacillus when developing in the body causes the formation of toxins, albumoses, an organic acid, and a substance called antitoxin, which is present in the blood. Frequently the inherent quantity of antitoxin is sufficient to antagonize thoroughly the toxin produced, thereby insuring life; on the other hand, additional antitoxin may have to be introduced in order to save the patient. A culture of diphtheria bacilli may be grown on meat broth (alkaline nutrient bouillon) in a flask, to which have been added .5 p. c. of sodium chloride and 2 p. c. of peptone. After a week or more the bacilli are filtered off, when the remaining fluid should contain considerable *diphtheria toxin* of sufficient strength that ♏jss (.1 cc.) will kill a guinea-pig. Now of this ♏iij 15 (.2–1 cc.) are injected into a vein of a healthy young horse, which produce only slight symptoms; these having disappeared, a larger dose is administered to be followed with diphtheritic disturbances, and increasing doses repeated until ℥iij (90 cc.) are given at each injection with little or no effect, thereby insuring a large amount of antitoxin in the blood serum. After several months 1 gallon (4 L.) of blood is withdrawn from the jugular vein of the horse into a sterilized vessel, allowed to coagulate, and the *antitoxin serum* (containing 300–800 units of antitoxin to the cc.) placed in sterilized bottles, with some antiseptic (.5 p. c. phenol or .4 p. c. cresol), and hermetically sealed. Can only be prepared in establishments licensed by the Secretary of the Treasury, United States, and each container must bear on the outside label the name *Diphtheria Antitoxin*, the minimum number of units in the package, lot number, name, address, license number of manufacturer, and the date beyond which minimum potency may not

be maintained—one year if excess of potency be 20 p. c., 2 years if 30 p. c., 3 years if 40 p. c., 4 years if 50 p. c. If exposed to heat and light—loses 10–30 p. c. of strength in a year, but retains some for years. Must be dispensed in the unopened glass containers from manufacturers, and should be kept at 4.5–20° C. (40–68° F.), preferably the lower limit. Dose, curative: 10,000 units; protective: 1000 units.

PROPERTIES AND USES.—Diphtheria and immunity therefrom. The entire amount required should be given at one dose, and the sooner the better—intravenously, when urgent, slowly in vein at bend of elbow with strictly aseptic injection needle. Should always give by hypodermic, intramuscular or intravenous routes, never by mouth or rectum as these are valueless. Inject where subcutaneous tissue is loose—back, near angle of the scapula, on side of abdomen, or the buttocks (intramuscular—more rapid and effective than subcutaneous). If no improvement within a few hours repeat the dose, Valuable for prophylaxis as one injection, 1000 units, immunizes, for 3 or more years, 80 p. c. of individuals, two injections 90 p. c. and three injections 97 p. c. The earlier the treatment the more certain the cure; erythematous rash, painful and swollen joints, fluctuations in temperature, etc., may follow several weeks after its use; large doses are not poisonous, and produce least distention of the tissues.

4. **Antitoxinum Tetanicum. Tetanus Antitoxin,** *U.S.P.*—Syn., Antitox. Tet., Serum Antitetanicum Purificatum, U.S.P. 1910, Purified Antitetanic Serum, Concentrated (Refined) Tetanus Antitoxin, Antitetanic Globulins; Fr. Sérum antitetanique; Ger. Tetanus-(Heil)serum.)

Manufacture: It is an aqueous solution of certain antitoxic substances obtained from the blood serum or plasma of an animal of the genus *Equus* (*E. cabal'lus*), which has been properly immunized against tetanus toxin; after the serum or plasma from the immunized animal has been collected, the antitoxin-bearing globulins are separated from the other constituents of the serum or plasma (by adding ammonium sulphate) and dissolved in water; then sodium chloride and a preservative are added, solution filtered through a bacteria-excluding filter, that yields a potency of not less than 300 units per cc. It is a transparent, slightly opalescent liquid, sometimes with a slight granular deposit, of a faint brownish, yellowish, greenish color, nearly odorless, or slight odor of antiseptic used as a preservative. It must come from healthy animals, must be sterile, free from toxins, and must not contain an excess of preservative (not more than .5 p. c. of phenol, or .4 p. c. of cresol, when either used) and not more than 20 p. c. of total solids.

Commercial.—The tetanus toxins are most virulent poisons and their antitoxin, the first discovered, has the same physical and chemical properties as that of diphtheria. The serum is produced similar to the antidiphtheric serum, using, however, for the repeated injections into the vein of a healthy young horse cultures of the tetanus bacillus, which must be grown in deeper vessels on a special broth having been heated to expel all possible oxygen, as in its presence this bacteria

does not thrive; also the poison it forms is very unstable and should be used when fresh, or most carefully preserved. It is not only curative but a most valuable prophylactic reducing mortality 20–35 p. c. Administration should be by subcutaneous or intraspinal injection, using great care in asepsis.

Can only be prepared in establishments licensed by the Secretary of the Treasury. United States, and each container must bear on the outside label the name, *Tetanus Antitoxin*, the minimum number of units in the package, lot number, name, address, license number of manufacturer, and the date beyond which minimum potency may not be maintained—one year, if excess of potency be 20 p. c., 2 years, if 30 p. c., 3 years, if 40 p. c., 4 years if 50 p. c. Must be dispensed in the unopened glass containers from manufacturers, and should be kept at 4.5–20° C. (40–68° F.), preferably the lower limit. Dose, curative: 10,000 units; protective: 1500 units.

PREPARATION.—1. *Antitoxinum Tetanicum Crudum.* Crude Tetanus Antitoxin. (Syn., Antitox. Tet. Crud., Serum Antitetanicum, U.S.P. 1910, Antitetanic Serum, Crude Antitetanic Serum, Unconcentrated (Unrefined) Tetanus Antitoxin.) A fluid having a potency of not less than 150 units per cc., separated from the coagulated blood of an animal of the genus *Equus* (*E. cabal'lus*), which has been properly immunized against tetanus toxin; although this preparation is weaker, our Government enforces identical restrictions and safe-guards in its manufacture, handling, preservation and dispensing as of *Tetanus Antitoxin*. Important in veterinary practice. Dose, curative: 10,000 units; protective: 1500 units.

PROPERTIES AND USES.—Tetanus (tonic spasm of some or all of the voluntary muscles, when confined to lower jaw, usually part first affected—lockjaw, trismus), an infection as a rule through a wound, when it is well to enlarge incision sufficient to admit air and remove any foreign substance, thereby employing good surgery as well as abundant serum; ʒijss (10 cc.), every 6 hours for several days, unless symptoms improve. May trephine skull and inject into brain direct ♏xv–45 (1–3 cc.), but action uncertain. For treatment—give at once 5000 units intraspinally and 10,000 units intravenously, repeat the former daily, the latter (subcutaneously) within a few days; in severe wounds repeat injection once a week until healed; sometimes the powder is dusted over wound, but absorption unreliable; as a prophylactic reduces mortality 35–71 p. c.

5. **Vaccinum Variolæ. Smallpox Vaccine,** *U.S.P.*—(Syn., Vaccin. Var., Virus Vaccinicum, U.S.P. 1910, Glycerinated Vaccine Virus, Jennerian Vaccine; Fr. Vaccin; Ger. Impfstoff.)

Manufacture: It consists of a glycerinated suspension of the vesicles of vaccinia or cowpox obtained from healthy vaccinated animals (calves) of the bovine (*Bos taurus*) species; vesicles must be removed aseptically from animal at maximum potency, thoroughly triturated into smooth suspension with an aqueous solution of glycerin, which

must not be acid to bromcresol purple T. S., or distinctly alkaline to phenol red T. S. Loses potency rapidly at moderate temperature and must be kept below 5° C. (41° F.).

Commercial.—The ravages of smallpox in civilized communities, prior to Jenner's discovery, May 14, 1796, often included one-tenth of the entire population. It had been observed that dairymaids who contracted cowpox were immune from smallpox, and, after twenty years of close observation and study of the subject, Jenner on the above date vaccinated a boy with a cowpox scab taken from the hand of his father's milkmaid, and after a few weeks intermission inoculated the same boy with smallpox virus without producing, however, the slightest symptoms of that disease, a fact which, upon further verification by him, lead immediately to the establishment of his belief and claim. Owing to blood taints and lurking disease human virus no longer is employed, but only that coming from healthy bovine animals (calves 2–3 years old), those having no communicable malady, or even suspected of it, other than vaccinia; each animal must be subjected to a tuberculin test and held in quarantine a week under daily veterinary inspection prior to vaccination and as soon as the vaccine pulp is removed a necropsy must be performed and permanent records kept. Each lot of virus must be examined, and records kept to determine absence of undue bacterial content, tetanus organisms and other pathogenic anaërobes and the finished product must be placed in sterile containers bearing upon the label its name, lot number, directions for storage, also name, address, license number of the manufacturer licensed by the Secretary of the Treasury, United States, as well as the date beyond which the product is likely to be unreliable. It must be kept at a temperature not above 5° C. (41° F.). Prior to vaccination every community had its pock-marked faces and a large annual death toll from its ravages, but such, happily, all future generations will be spared. One single incision, $\frac{1}{4}$ inch long, not sufficiently deep to draw the blood, is all that is necessary on the front of upper arm well-cleansed with soap, water, alcohol or ether and dried, being careful to encourage absorption by rubbing with a sterilized needle. Physicians should see arm the third, sixth and ninth day; papule usually appears on fourth day, vesicle on the fifth, and pustule on the eighth. Infants, without eczema or marasmus, should be vaccinated prior to teething, and re-vaccination should occur at every epidemic or threatened exposure.

6. **Pituitarium. Pituitary,** *U.S.P.*—(Syn., Pituitar., Hypophysis Sicca, U.S.P. 1910.) The cleaned, dried and powdered posterior lobe obtained from the pituitary body of domesticated animals which are used for food by man. It is a yellowish, grayish, amorphous powder, characteristic odor, partially soluble in water. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Commercial.—The pituitary gland is a small bean-shaped body at the base of the brain having a small posterior lobe and a larger anterior

lobe with a dissimilar action; in man it is 12 Mm. (½′) broad, 7 Mm. (⅓′) long, weighing 5–20 gr. (.3–1.3 Gm.); in cattle weighing 2–3 drams (8–12 Gm.).

PREPARATION.—1. *Liquor Pituitarii.* Solution of Pituitary. (Syn., Liq. Pituitar., Liquor Hypophysis, U.S.P. 1910, Pituitary Extract, Solution of the Pituitary Body, Ger. Hypophysislösung.)

Manufacture: Contains the water-soluble principle (principles) from the fresh posterior lobe of the pituitary body of cattle, 1 cc. having an activity upon isolated uterus of the virgin guinea-pig corresponding to 80–120 p. c. of that produced by .005 Gm. of the standard Powdered Pituitary. It is a transparent, colorless or nearly so, sterile liquid, with faint characteristic odor. Valuable hypodermic solution, 2–5 times weaker than proprietary preparations on the market (pituitrin, pituitol, hypophysin, etc.). Dose, ♏x–20 (.6–1.3 cc.); seldom given by mouth, when it is less effective.

PROPERTIES AND USES.—Cardiac stimulant, diuretic (dilates renal vessels, increases urine; stimulates unstriped muscles—circulation (bloodvessels, arteries), uterine, intestinal; increases lacteal flow, arterial pressure, and vigor of individual uterine contractions; in labor usually best to delay use until head is born, as its quick primary effect is not sustained, and then give ergot which maintains a longer action; diminishes amount of urine but renders it more concentrated; menorrhagia, metrorrhagia, surgical shock, hay fever, rickets; as effects only last 1–2 hours, not reliable in postpartum hemorrhage.

7. **Hydrophobia Antidote.**—While this is not a true antitoxin. it is prepared somewhat similarly; thus a rabbit is inoculated with the spinal cord of an animal that has died of hydrophobia; from the spinal cord of this rabbit others are inoculated in a series of gradually increasing intensity until the spinal cord contains a virus whose incubation period is seven days. The patient is inoculated first with a rabbit's spinal cord of low degree of virulence, the next day with one of higher intensity, and so increased for several weeks, when one usually is immuned, provided treatment was begun soon after the bite of the rabid dog was received.

8. **Streptococcus Antitoxin.**—This serum is prepared similary to the preceding, using, however, several rabbits, as well as finally the horse, for increasing the virulence, and not bleeding the latter until a year after the first inoculation. These streptococci produce the severe forms of septicemia following the puerperium, after injuries and operations, in erysipelas, scarlet fever, etc. Dose, ʒijss–5 (10–20 cc.).

9. **Lac Vaccinum. Cow's Milk,** *N. F.*—The fresh, unpasteurized milk of the domestic cow (*Bos taurus*), without modification, and complying with the legal standard of the State or community in which it is sold; this secretion of the mammary glands is a white, opaque liquid (emulsion) of minute fat globules suspended in solution of casein, albumin, lactose and inorganic salts, pleasant taste, slight odor; upon standing few hours the oily globules (cream) owing to lightness separate to the

surface; each is surrounded by an albuminous envelope which may be dissolved by an alkali, thus liberating and permitting aggregation into butter; contains water 87 p. c., solids 13 p. c.—lactose 4 p. c., butter fat 4 p. c., casein 4.40 p. c., salts (chiefly phosphates) .6 p. c. By churning the fat globules unite to form butter, leaving a liquid called *buttermilk* —solution of lactose, salts, some casein and butter fat; skimmed milk develops lactic acid and separates the casein as a coagulum—*curd*, either upon standing (through action of a certain bacterium), or the addition of other acids, or rennet (prepared inner membrane of calf's stomach); the liquid separated from the coagulum is *whey*, which contains lactose and salts; the coagulum upon the addition of salt and proper manipulation gives *cheese*. Human milk is always alkaline, that of cow's either alkaline or acid. *Humanized Milk* may be prepared by mixing: cream ℥j (30 cc.), cow's milk ℥iv (15 cc.), lime water ℥j (30 cc.), water ℥iss (45 cc.), lactose gr. 30 (2 Gm.). *Condensed Milk* is prepared by evaporating milk to the consistence of thick cream (one-fourth its bulk), usually adding sugar (sucrose) for preservation and transportation; 1. *Lac Fermentatum, Fermented Milk* (Kumyss, Koumyss, Kefir, Matzoon). Dissolve sucrose 35 Gm. in cow's milk 1000 cc., in a strong bottle, add compressed yeast (Fleischmann's) 3 Gm., close securely, keep at 23–32° C. (73–90° F.) for 6 hours, transfer to cool place, preferably refrigerator. It is a cream-like liquid, strongly frothing, pleasant acid taste, containing casein, alcohol, lactic acid, carbon dioxide, fat, lactose, albumin, hemialbumose, peptone—these varying somewhat according to length of fermentation, alcohol and carbon dioxide increasing continuously. Fermented milk is more readily digested and absorbed than milk; quenches thirst, relieves hunger, stimulates circulatory, nervous, and respiratory systems, increases nutrition, urine, perspiration; indigestion due to either depression or stomach irritability, enteric fever, typhoid state, secondary anemias, chronic constitutional diseases. Dose, ℥viij (240 cc.). *Malted Milk* is obtained by evaporating milk and extract of malt (from a mash of ground malt and flour) having the combined enzymic action, also 7.5 p. c. butter fat and 3.5 moisture.

10. **Butyrum, Butter.**—This is obtained by churning, the cream rising to the surface of cow's milk. It is soft, yellow, neutral (if acid, due to free butyric acid), sp. gr. 0.930, melts at 32° C. (89.6° F.), congeals at 23° C. (73° F.); odor delicate, sweet; taste bland; contains olein 30 p. c., palmitin and stearin 68 p. c., about 2 p. c. glycerides of butyric, capronic, caprylic, and caprinic acids. When employed in medicine, should be freed from salt and casein by melting it in warm water and decanting the clear liquid. If 100 parts be saponified by alkali, and the soap decomposed by hydrochloric acid, get fat acids, which, after washing (to remove 8 p. c. volatile fat acids) and drying, weighs 85–88 parts; other fats yield about 95 p. c. of fat acids insoluble in water. Used as demulcent, lenitive, ointment, dietetic.

11. **Oleum Bubulum, Neat's-foot Oil.**—Obtained by boiling in water the fatty tissue of the feet of the ox, deprived of hoofs, skimming oil from the surface, keeping it some time on warm water for impurities to settle; it is yellowish, peculiar odor; used for softening leather, etc.; for cod-liver oil, but occasions diarrhea.

12. **Sanguis, Blood.**—This, the arterial fluid of the ox, is red, opaque, peculiar odor, sp. gr. 1.050; consists of blood corpuscle in suspension; coagulates on exposure, separating the clot (cruor) from the liquid (serum); contains water 78 p. c., albumin 7 p. c., fibrin .4 p. c., corpuscles, hemoglobin, etc., 13 p. c., salts .9 p. c.—alkalies, calcium and magnesium chlorides, phosphates, sulphates; the serum contains 10 p. c. solids—8 p. c. of which are albuminoids. When evaporated have extractum or pulvis sanguinis. Used as restorative. Dose, gr. 5–15 (.3–1 Gm.).

13. **Os, Bone.**—The skeleton of vertebrate animals, U.S.P. 1830–1870. Bone has a solid, white, smooth, lamellated texture, internally porous, consisting of a cellular gelatinous tissue filled with calcareous deposits (earthy salts). It is insoluble in water, soluble in hydrochloric acid with effervescence, leaving behind a gelatinous mass (ossein); contains calcium phosphate 40–67 p. c., calcium carbonate 5–10 p. c., magnesium phosphate 1–2 p. c., calcium fluoride 1 p. c., traces of Si, Fe, Mn, NaCl. Ossein yields gelatin when boiled with water; when dry distilled get Dippel's animal oil, containing pyridine, picoline, and other bases. Used for preparing animal charcoal (bone-black), phosphates, superphosphates (manure).

RECAPITULATION TABLE NO. 7—U.S.P. DRUGS AND PREPARATIONS.

Class and family. 1. Latin official name. 2. Eng. official name.	Zoölogic source.	Part official.	Habitat.	Constituents.	Official preparations.	Medicinal properties.	Medicinal uses.	Doses.
Class *Insecta.* Order (Family) *Hemiptera.* 1. Coccus. 2. Cochineal.	Coccus cacti.	The dried female insect.	Mexico, C. America.	Carminic acid, coccerin, fixed oil, vol. oil.	Tinct. card. comp. —carmine.	Stimulant, diuretic, antispasmodic.	Whooping-cough, neuralgia, for coloring preparations.	Grains. 1–15 (.06–1 Gm.).
Class *Insecta.* Order (Family) *Coleoptera.* 1. Cantharis. 2. Cantharides.	Cantharis vesicatoria.	The dried insects.	S. and C. Europe, W. Asia.	Cantharidin, fat, odorous compound, extractive, salts.	Cerate, plaster, tincture.	Diuretic, aphrodisiac, emmenagogue, rubefacient, acrid poison.	Dropsy, bronchitis, bladder debility, gleet, diabetes, amenorrhea, ulcers, brain congestion, pleurisy, dysmenorrhea, rheumatism, tetanus, apoplexy, meningitis.	$\frac{1}{6}$–1 (.01–.06 Gm.).
Class *Insecta.* Order (Family) *Hymenoptera.* 1. Mel. 2. Honey.	Apis mellifera.	A saccharine substance (secretion).	N. America, Europe.	Grape-sugar, wax, vol. oil, proteins, mucilage, formic acid, coloring.	Mel rosæ, Hg. cum Cret., mass Fe carb.	Demulcent, laxative, stimulant, nutritive.	Aphthæ (thrush), boils, fissures.	Ad libitum.
1. Cera Flava. 2. Yellow Wax.		A product from the honey-comb.	.....	Hydrocarbons, cerin, myricin.	Canthar. cerate, rosin cerate, cer. alb., cerate, oint., oint. bor. ac., oint. bel., oint. phenol., oint. pic. pin., adhes. plaster.	Protective, demulcent, emollient.	Plasters, cerates, ointments, diarrhea, neuralgia, gleet, protective.	Externally.
Class *Pisces.* Order (Family) *Teleostia.* 1. Oleum Morrhuæ. 2. Cod-liver Oil.	Gadus Morrhua, +.	A fixed oil from the fresh livers.	N. Atlantic Ocean.	Olein, palmitin, stearin, iodine, aselline, morrhuine, chlorine, bromine, phosphorus.	Emulsion.	Alterative, demulcent, nutrient.	Wasting diseases, phthisis, bronchitis, rheumatism, skin affections, nerve tonic, scrofula, arthritis (gout).	Minims. 3j–4 (4–15 cc.).
Class *Mammalia.* Order (Family) *Cetacea.* 1 Cetaceum. 2 Spermaceti.	Physeter macrocephalus.	A fatty substance from the head.	Pacific and Indian Oceans.	Cetylic alcohol combined with palmitic acid, cetin.	Ung. aq. ros.	Lenitive, demulcent, emollient.	Base of cerates, ointments, etc., urinary irritation.	Externally.

Class *Mammalia.* Order (Family) *Pachydermata.*								
1. Adeps.	hog	The purified internal fat.	.....	Olein, palmitin, stearin.	Benz. lard, cerate, ointment, +.	Emollient—in poultices, etc.	To protect surfaces.	
2. Lard.								
1. Pancreatinum.	Sus scrofa var. domesticus.	Mixture of enzymes.	Universal.	.....	.....	Ferment.	Dyspepsia, indigestion.	Grains. 5–15 (.3–1 Gm.).
2. Pancreatin.								
1. Pepsinum.		Mixture containing enzyme.	.....	.....	.....	Ferment.	Dyspepsia, indigestion, diarrhea.	5–30 (.3–2 Gm.).
2. Pepsin.								
Class *Mammalia.* Order (Family) *Ruminantia.*								
1. Sevum Præparatum.	sheep	The purified internal fat.		Stearin, palmitin, olein, hircin.	Ointments of mercury (2).	Lenitive.	Dressing blisters, excoriated surfaces, chapped hands.	Externally.
2. Prepared Suet.		The purified fat-like substance from the wool.		Cholesterin, alcohols, esters of lano, palmitic, myristic, carnaubic, oleic acids.	Hydrous wool fat, plasters, ointments.			
1. Adeps Lanæ.	Ovis aries.		Universal.					
2. Wool Fat.								
1. Thyroideum.		The cleaned, powdered thyroid gland.		Thyroxin.	.....	Influences nutrition and metabolism, depressant.	Dementia, cretinism, myxœdema, goiter, obesity, mania.	Grains. 5–10 (.3–.6 Gm.). Thyroxin: gr. $\frac{1}{240}$–$\frac{1}{60}$ (.00025–.001 Gm.).
2. Thyroid.								
1. Fel Bovis.	cow	The fresh bile.		Glycocholates, taurocholatis, bilirubin, mucilage, cholesterin, choline, mucin, urea, salts.	Extract fel. bov.	Tonic, laxative, cholagogue, antiseptic, vermifuge	Constipation, dyspepsia, jaundice, glandular enlargements.	5–15 (.3–1 Gm.).
2. Oxgall.								
1. Lactosum.	Bos taurus.	A sugar from milk.	Universal.	$C_{12}H_{22}O_{11}.H_2O$.	Pulv. ipecac. et opii, ferr. carb. sacch., triturates.	Diuretic, diluent.	Cardiac dropsy, wasting diseases, consumption.	480–2400 (30–150 Gm.).
2. Lactose.								
1. Vaccinum Variolæ.				Vaccinia vesicles.	.....	Prophylactic.	Smallpox.	
2. Smallpox Vaccine.								
1. Pituitarium.		Pituitary body (gland)		.....	Liquor.	Cardiac stimulant, diuretic, ecbolic.	Dilates renal vessels, increases urine, milk, arterial pressure, uterine contractions.	
2. Pituitary.								
1. Antitoxinum Diphthericum.	Equus caballus.	Blood serum (plasma).	Universal.	Antitoxin.	.....	Prophylaxis, immunization.	Diphtheria.	1000–10,000 units.
2. Diphtheria Antitoxin.								
1. Antitoxinum Tetanicum.	.....	Blood serum (plasma).	.....	.....	Antitox. tet. crud.	.....	Tetanus.	1500–10,000 units.
2. Tetanus Antitoxin.								

PART III.

INORGANIC DRUGS FROM THE MINERAL KINGDOM.

I. METALLOIDS AND THEIR COMPOUNDS.

HYDROGEN.

$H^i = 1.008$.

THE element hydrogen (Gr. ὕδωρ, water, + γενής, producing, generates water—*i. e.*, upon combustion, becoming one of its components) is not official, although in combination, especially with oxygen, it forms most important compounds. It is found chiefly in water, animal and vegetable substances, all acids, and in the free state in gases from decomposing organic matters, intestines, and interior of the earth; it is combustible (blue flame) with intense heat, has great affinity for oxygen, often combining to form hydrates with dangerous reports and results.

Aqua. Water, H_2O, *U.S.P.*—(Syn., Hydrogen Monoxide; Fr. Eau; Ger. Aqua communis, Wasser.)

Natural water conforming to the following descriptions and tests. By this is meant any water—be it rain (*aqua pluvialis*), snow (*aqua nivalis*), spring (*aqua fontana*), river (*aqua fluvialis*), or lake (*aqua lacalis*)—suitable for drinking, which does not curdle soap, or contain copper, iron, lead, ammonium salts, nitrogenous and oxidizable substances, chlorides, nitrates, nitrites, organic substances, nor over .03 p. c. inorganic solids. It is a colorless, neutral, limpid liquid, practically tasteless and odorless; heated near boiling and agitated—evolves no disagreeable odor. *Impurities:* Iron, lead, copper, chloride, nitrite, nitrate, solids, ammonium salts, nitrogenous, and oxidizable substances.

PREPARATIONS.—1. *Aqua Destillata.* Distilled Water, H_2O. (Syn., Aq. Dest.; Fr. Eau distillée, Hydrolat simple; Ger. Destilliertes Wasser.). Water purified by distillation.

Manufacture: Distil water 1000 vol., reject first 100 vol., collect the next 750 vol. The first portion is liable to contain volatile substances, the last solid and organic matter, hence both are rejected. It is colorless, limpid liquid, odorless, tasteless, neutral to phenolphthalein T. S. and to methyl orange T. S. *Impurities:* Heavy metals, calcium, chloride, sulphate, ammonia, carbon dioxide, oxidizable

substances. Should be kept in glass-stoppered bottles, having been rinsed with hot distilled water just prior to filling.

2. *Aqua Destillata Sterilisata.* Sterilized Distilled Water, H_2O. (Syn., Aq. Dest. Steril.; Ger. Sterilisirtes Destilliertes Wasser.)

Manufacture: Place freshly distilled water, neutral to litmus, in sterilized containers of insoluble glass, each 1000 cc. capacity, stopper with plugs of purified absorbent cotton, wrapped in gauze; fasten stout, non-absorbent paper or tinfoil over top of plug and lip of flask—sterilize in an autoclave under steam pressure, 115° C. (239° F.), for 30 minutes, or boil the filled stoppered containers actively for 1 hour, allow water to cool without removing the cotton plug; until ready for use protect mouth of flask and plug from infection through dust by wrapping top of flask tightly with paper. Should be used within 24 hours after distillation if for intravenous injection; for other uses it is preferable to resterilize the water after each opening and that it be used within a month after its preparation.

Preps.: 1. *Ampullæ Caffeinæ Sodio-Benzoatis, N.F.*, 34 ℳ. each. 2. *Ampullæ Quininæ et Ureæ Hydrochloridi, N.F.*, 17 ℳ. each. 3. *Ampullæ Quininæ Dihydrochloridi, N.F.*, 17 ℳ. each. 4. *Ampullæ Sodii Cacodylatis, N.F.*, 17 ℳ. each. 5. *Liquor Procainæ Hydrochloridi, N.F.*, q. s.

The purer water is the softer; hard water curdles soap from presence of calcium (sulphate, carbonate) or magnesium salts, consequently it is poorly adapted for domestic use.

Properties.—Demulcent, diuretic, diaphoretic, solvent, diluent.

Vapor bath accelerates circulation, causes profuse sweating.

Hot bath stimulates, producing redness of face and skin.

Warm bath slows respiration, reduces body temperature, relaxes skin, causes sleep. Valuable in febrile exanthematous diseases.

Cold bath abstracts heat, sometimes stimulant, tonic, sedative. Popular and very useful in febrile conditions, especially typhoid.

Mineral Waters.—In addition to the three preceding official waters a number of natural waters are used medicinally, which contain one or more chemicals, being named according to some active ingredient or therapeutic value. Thus we have:

Alkaline waters, containing $NaHCO_3$ (usually predominates), NaCl, Na_2SO_4, and often free CO_2—Vichy, Kissingen, Carlsbad, Ems, Saratoga.

Chalybeate waters, containing $FeSO_4$, Fe_2CO_3—Wiesbaden, Brighton, Spa, Bedford, Rockbridge Alum.

Hepatic or sulphur waters, containing H_2S—Aix-la-Chapelle, White Sulphur, Blue Lick, Sharon, Richfield.

Bitter waters, containing $MgSO_4$, $MgCl_2$—Hunyadi, Friedrichshall.

Carbonated waters, containing Ca, Mg, Fe—carbonates held in solution by CO_2—Seltzer, Apollinaris, Old Sweet, White Rock, etc.

Lithia waters, containing lithium salts—Buffalo, Londonderry, Magnetic.

The list of such springs is lengthy, and all are asserted to be specific for one or more ailments. To obtain the benefit claimed, it is always best to visit the spring itself, and there, free from cares, worries, etc., drink the waters under the directions of a resident physician.

Liquor Hydrogenii Dioxidi. Solution of Hydrogen Dioxide, H_2O_2, *U.S.P.*—(Syn., Liq. Hydrog. Diox., Solution of Hydrogen Peroxide, Aqua Hydrogenii Dioxidi, U.S.P. 1900, Oxygenized Water, Oxygen Hydrate; Br. Liquor Hydrogenii Peroxidi; Fr. Soluté de Peroxide d'Hydrogen; Ger. Wasserstoffsuperoxydlösung.)

Manufacture: Produce hydrated magma, by shaking vigorously, barium dioxide 300 Gm. in cold distilled water 500 cc., keep at 10° C. (50° F.), shake now and then vigorously, until fully hydrated; mix phosphoric acid 96 cc. with distilled water 320 cc., reserve 50 cc., and to the remainder add the hydrated magma, shaking, cooling, and acidifying with the reserve occasionally, wash precipitate (barium phosphate) with distilled water q. s. 1000 cc.; after filtration (aided by a little starch) add 30 drops of diluted sulphuric acid—until it ceases to produce cloudiness; mix cloudy liquid with starch 10 Gm., agitate, filter, assay, adjust to official strength—$BaO_2 + 2H_3PO_4 = Ba(H_2PO_4)_2 + H_2O_2$. It is a colorless aqueous liquid, odorless, or odor of ozone, slightly acid taste and reaction, producing a peculiar sensation and froth in the mouth; deteriorates upon keeping or prolonged agitation; rapidly decomposed by many oxidizing and reducing substances; substituting a stopper coated with paraffin or a pledget of purified cotton retards deterioration; contains 3 p. c. by weight of hydrogen dioxide, H_2O_2, corresponding to 10 volumes of available oxygen. *Tests:* 1. Expose to air at ordinary temperature, or heat on water-bath at 60° C. (140° F.)—loses chiefly water; rapidly heated it frequently decomposes suddenly. 2. Shake 1 cc. with 10 cc. of distilled water containing 1 drop of diluted sulphuric acid, add ether 2 cc., + a drop of potassium dichromate T. S.—aqueous layer blue color, which passes into the ethereal layer upon agitation. *Impurities:* Heavy metals, arsenic, barium, free acid, oxalic acid, hydrofluoric acid, non-volatile matter, preservative. Upon removing stopper from the bottle only slight pressure should be observed. Should be kept cool protected from light and dust. Dose, ʒj–3 (4–12 cc.).

Properties.—Oxidizant, stimulant (nervous system), increases urine, antiseptic, decomposes pus, kills microbes, prevents fermentation.

Uses.—Diabetes, atonic dyspepsia, dyspnea, epilepsy, low fevers, whooping-cough, asthma, phthisis, anemia, chlorosis, pneumonia; locally, in mucous membrane inflammations, wounds, ulcers, ozena, ophthalmia, gonorrhea, leucorrhea, chancres, otorrhea, rhinitis, diphtheria, bronchitis, fetid breath, cystitis, spray, gargle. *Pyrozone* is claimed to be 50 p. c. When hydrogen dioxide is dissolved in glycerin instead of water, we have *glycozone.*

OXYGENIUM. OXYGEN, *U.S.P.*

$O^{ii} = 16.$

(Syn., Fr. Oxygéne; Ger. Oxygen, Sauerstoff.)

The element oxygen (Gr. *ὀξύς*, acid, sharp, + *γενής*, producing—*i. e.*, a generator of acids, once supposed a component of all acids) is official, being most widely distributed and abundant, excelling all others in quantity, as it constitutes 89 p. c., by weight, of the water, 20 p. c. of the atmosphere, 30–50 p. c. of the rocks, and 45 p. c. of the total weight of our earth, besides being in most animal and plant tissues; it occurs in the free state, also in combination, uniting with acid and basic substances to form oxides.

Manufacture: Heat together, at low red heat, potassium chlorate (4–5) and manganese dioxide (1), and pass the evolved gas (oxygen +) through a wash-bottle containing an alkali—$5KClO_3 + MnO_2 = 3KClO_4 + 2KCl + MnO_2 + O_3$. It is a colorless, odorless, tasteless gas, supports combustion more readily than air, in it glowing wood splinters burst into flame, soluble in water (34), alcohol (3.6), noninflammable, neutral reaction; contains 98 p. c., by volume, of O. *Impurities:* Carbon dioxide, halogens, acids, alkalies, oxydizing substances.

Properties and Uses.—In diseases of respiratory and circulatory systems where an imperfect supply reaches the tissues, thereby improving the condition of the blood, cyanosis from impaired respiration, disagreeable after-effects of ether, chloroform, dyspnea from Bright's disease or diabetes, mechanical hindrance. For convenience usually compressed hydraulically at very low temperature (225 pounds—to $\frac{1}{15}$ its volume) in metal (steel) cylinders, to which a mouth-piece is attached for inhalation; it may be inhaled from a jet under the nostrils.

NITROGEN.

$N^{iii} = 14.008.$

The element nitrogen (Gr. *νίτρον*, L. *nitrum*, niter, + *γενής*, *γένος*, produced from or generator of) is of considerable importance in medicine, owing to its ready combination with hydrogen and oxygen, thus forming several useful official compounds.

Aqua Ammoniæ. Ammonia Water, NH_4OH, *U.S.P.*—(Syn., Aq. Ammon., Solution of Ammonium Hydroxide, Spirit of Hartshorn; Br. Liquor Ammoniæ, Spiritus Salis Ammoniaci Causticus, Ammonia Aqua Soluta; Fr. Ammoniaque liquide, Eau (Solution, Liqueur) d'Ammoniaque; Ger. Liquor Ammonii caustici, Ammoniakflüssigkeit, Salmiakgeist, Atzammoniak.) An aqueous solution of ammonia (NH_3) containing 9.5–10.5 p. c., by weight, of gaseous ammonia, NH_3.

Manufacture: Heat gradually ammonium chloride and calcium hydroxide mixed together, and pass the gas thus generated into water —$2NH_4Cl + Ca(OH)_2 = CaCl_2 + 2H_2O + 2NH_3$. It is a colorless transparent liquid, very pungent characteristic odor, caustic, alkaline taste and reaction; sp. gr. 0.958. *Tests:* 1. Produces dense white fumes in the presence of hydrochloric acid. 2. Evaporate 25 cc. to dryness—residue .005 Gm. *Impurities:* Heavy metals, oxidizable substances. Should be kept cool in glass-stoppered or rubber-stoppered bottles made of hard glass free from lead, and, deteriorating with age, must be assayed frequently. Dose, ♏x–20 (.6–1.3 cc.), well diluted.

Preparations.—1. *Spiritus Ammoniæ Aromaticus.* Aromatic Spirit of Ammonia. (Syn., Sp. Ammon. Arom., Spiritus Ammoniæ Compositus, Spirit of Sal Volatile; Fr. Alcoolat ammoniacal aromatique; Ger. Aromatischer Ammoniakgeist.)

Manufacture: Dissolve ammonium carbonate 3.4 Gm. in ammonia water 9 cc. + distilled water 14, agitating gently; dissolve oil of lemon 1 cc., oils of lavender, myristica, each $\frac{1}{10}$, in alcohol 70, in 100 cc. volumetric flask, and to this add gradually ammonium carbonate solution, add distilled water q. s. 100 cc.; set aside in a cool place 24 hours, agitating occasionally, filter through covered funnel. It is a nearly colorless liquid when fresh, but gradually acquires a yellow color, aromatic pungent odor, and taste of ammonia; sp. gr. 0.900. Should be kept cool, in glass-stoppered bottles. Dose, ♏x–60 (.6–4cc.), well diluted.

Preps.: 1. *Tinctura Valerianæ Ammoniata,* valerian 20 p. c., sp. ammon. arom. q. s. 100. 2. *Tinctura Guaiaci Ammoniata, N.F.,* guaiac 20 p. c., sp. ammon. arom. q. s. 100. 3. *Liquor Sodæ et Menthæ, N.F.,* sp. ammon. arom. 2 p. c.

2. *Fluidextractum Senegæ,* q. s. 3. *Syrupus Senegæ,* 1 p. c. 4. *Linimentum Ammoniæ, N.F.,* 25 p. c., ammonia water 25 p. c., sesame oil 75, agitate until uniform mixture. 5. *Spiritus Ammoniæ Anisatus, N.F.,* ammonia water 20 p. c. 6. *Lotio Ammoniacalis Camphorata, N.F.,* ammonia water 6 p. c. 7. *Linimentum Opii Compositum, N.F.,* ammonia water 35 p. c. 8. *Linimentum Saponato-Camphoratum, N.F.,* ammonia water 5 p. c.

Unoff. Prep.: Spiritus Ammoniæ, 10 p. c. (condensing gas in alcohol instead of water), ♏x–30 (.6–2 cc.), well diluted.

Properties.—Stimulant, antacid, irritant, rubefacient, caustic, corrosive poison; before meals increases, but after neutralizes gastric juice.

Uses.—Heartburn, nauseating headache, stimulates circulation and respiration, paralyzes the heart muscle. It is oxidized in the system, forming nitric acid, which is eliminated by kidneys; externally in rheumatism, neuralgia, congestion of larynx, throat, bowels, amenorrhea, burns, frost-bite, vulvar pruritus, syncope, bronchitis, hoarseness, acidity, whooping-cough, stings (of bees, mosquitoes, spiders, wasps, etc.); antidote to chlorine, bromine, hydrocyanic acid, alcoholic intoxication; mixed with oil should be applied by gentle friction. Aromatic

Spirit—most valuable diffusible stimulant; antispasmodic; headache, flatulency, nausea, shock, heart failure, etc.

Poisoning: Have burning pain from mouth to stomach; difficult deglutition, vomiting and purging of blood and mucus, cold and clammy skin, feeble pulse, collapse, sense of suffocation, convulsions, stupor, coma. Give vegetable acids (vinegar, lemon juice), oil, demulcents, stimulants (atropine, strychnine, digitalis, brandy, etc.), opium for the pain.

Synergists: Cardiac and diffusible stimulants, antispasmodics, capsicum, cantharides, counter-irritants.

Aqua Ammoniæ Fortior. Stronger Ammonia Water, HN_4OH, *U.S.P.*—(Syn., Aq. Ammon. Fort., Br. Liquor Ammoniæ Fortis; Fr. Eau d'Ammoniaque forte; Ger. Stärker Salmiakgeist.) An aqueous solution of ammonia (NH_3), containing 27–29 p. c., by weight, of gaseous ammonia, NH_3.

Manufacture: Same as aqua ammoniæ, only much more ammonia (gas) is required to give the 27–29 p. c. saturation. It is a colorless, transparent, liquid, excessively pungent characteristic odor, very caustic alkaline taste and reaction; sp. gr. 0.897; diluted with distilled water (2)—responds to tests for identity and purity of aqua ammoniæ. Should be kept cool in partly filled, strong glass-stoppered bottles made of hard glass free from lead, handled with great care (never tasted unless greatly diluted), and, deteriorating with age, must be assayed frequently. Dose, ♏ij–6 (.2–.4 cc.), well diluted.

Preparations.—1. *Petroxolinum Liquidum, N.F.*, 5 p. c. 2. *Petroxolinum Spissum, N.F.*, 5 p. c. 3. *Tinctura Iodidorum, N.F.*, 10 p. c.

Properties and Uses.—Too strong for internal use unless largely diluted. Externally—rubefacient; should be mixed with spirit of camphor, oil of rosemary, etc., for rheumatism, neuralgia, spasmodic and inflammatory affections. Spirit is stimulant, antispasmodic: given in hysteria, flatulent colic, nervous debility, nauseating headache.

Nitrogenii Monoxidum. Nitrogen Monoxide, N_2O, *U.S.P.*—(Syn., Nitrogen. Monox., Nitrous Oxide, Laughing Gas; Fr. Oxyde nitreux, Protoxyde d'azote; Ger. Stickstoffoxydul, Lachgas.)

Manufacture: Heat gradually pure ammonium nitrate (without chloride) to 200–240° C. (392–464° F.)—NH_4NO_3 + heat = $2H_2O$ + N_2O—pass gas through solution of ferrous sulphate to remove nitric oxide, and solution of potassium hydroxide to neutralize acids and chlorine; higher temperature produces white fumes (nitrous oxide, nitrogen, ammonia), when heat should be reduced. It is a colorless gas, slight characteristic odor, sweetish taste, non-inflammable, supports combustion of many substances; by cold and pressure condensed into liquid, then into crystals, soluble in water (1 vol. dissolving 1.3 vols.), alcohol, volatile and fixed oils. *Impurities:* Carbon dioxide, halogens, acids, alkalies, reducing substances—removed by passing gas through solutions of potassium hydroxide and ferrous sulphate.

Properties and Uses.—Anesthetic, stimulant, produces mental disturbances with hilarity, and as it raises arterial tension (pressure) should not be given to those having fatty heart or atheroma of the bloodvessels (producing apoplexy, heart failure); anesthesia due to influence on central nervous system and asphyxiation. Chiefly in dentistry for extracting teeth, minor operations; major surgery to produce primary anesthesia to be followed immediately by ether or chloroform. For convenience gas compressed in metallic (steel) cylinders; safest anesthetic, death-rate being only 1 in 500,000.

Acidum Nitricum. Nitric Acid, HNO_3, *U.S.P.*—(Syn., Acid. Nitric., Acidum Nitri (Azoticum), Spiritus Nitri Acidus, Spirit of Nitre, Aqua Fortis; Fr. Acide nitrique (azotique); Ger. Salpetersäure.) An aqueous solution containing 67–69 p. c. of HNO_3.

Manufacture: It is obtained by combining nitrogen pentoxide with water—$N_2O_5 + H_2O = 2HNO_3$; or by double decomposition between potassium nitrate or sodium nitrate and sulphuric acid, with heat—$NaNO_3 + H_2SO_4 = HNO_3 + NaHSO_4$, or $2NaNO_3 + H_2SO_4 = 2HNO_3 + Na_2SO_4$. It is a fuming, caustic, corrosive liquid; characteristic, highly irritating odor; strongly acid taste and reaction, even if highly diluted; sp. gr. 1.40; volatile at 110° C. (230° F.); dissolves copper, mercury, silver, and other metals with brownish-red fumes; stains woolen fabrics and animal tissues bright yellow. *Tests:* 1. Evaporate 20 cc.—residue .003 Gm. (abs. of non-volatile substances). 2. Shake 2.5 cc. with distilled water (7.5) + 2 cc. chloroform—latter colorless (abs. of bromine, iodine), even after adding metallic tin (abs. of bromic, iodic acids). 3. With distilled water (10) + barium chloride T. S.—no precipitate (abs. of sulphuric acid); with silver nitrate T. S.—no precipitate (abs. of hydrochloric acid). *Impurities:* Heavy metals, arsenic, bromine, iodine, bromic, hydrochloric, iodic, sulphuric acids, non-volatile substances. Should be kept dark, in dark amber-colored, glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 cc.), well diluted.

Preparations.—1. *Liquor Ferri Tersulphatis*, q. s. 2. *Acidum Nitrohydrochloricum, N.F.*, nitric acid 18 cc., hydrochloric acid 82 cc.; allow effervescence to cease. Dose, ♏ij–5 (.13–.3 cc.), well diluted. 3. *Acidum Nitrohydrochloricum Dilutum, N.F.*, nitric acid 10 cc., hydrochloric acid 45.5, distilled water q. s. 250 cc. Dose, ♏v–30 (.3–2 cc.), well diluted; only dispense either of these acids when 1–5 drops added to 1 cc. of an aqueous solution of potassium iodide (1 in 5) produce immediate liberation of iodine. 4. *Glyceritum Bismuthi, N.F.*, 16 p. c. 5. *Liquor Ferri Subsulphatis, N.F.*, q. s. 6. *Magma Bismuthi, N.F.*, 12 p. c.

Unoff. Prep.: Acidum Nitricum Dilutum, U. S. P. 1900, 10 p. c., nitric acid 100 Gm., distilled water 580 Gm.), ♏v–30 (.3–2 cc.), well diluted.

Properties.—Tonic, antiseptic, astringent, cholagogue, escharotic; stains yellow.

Uses.—Intestinal indigestion with diarrhea, syphilis, chronic hepatitis, intermittents, jaundice, scrofula, dysentery, whooping-cough, bronchitis, to allay thirst in fever, diabetes, diminishes phosphatic deposits in urine, gravel. Externally to destroy chancres, warts, hemorrhoids, phagedenic ulcers, bites of snakes and rabid dogs, tests for albumin in urine. As a lotion for ulcers, chilblains, and antiseptic purposes. Checks secretion of hydrochloric acid if given before meals.

Poisoning: Have burning acute pain over the entire affected tract, hiccough, nausea, vomiting (dark-colored mucous shreds, blood, etc.), swollen, tender cold abdomen, feeble pulse, clammy skin, difficult respiration, intense thirst; nearly always fatal. Give antidotes (alkaline solutions of sodium carbonate or bicarbonate, magnesium oxide, chalk), soap, mucilaginous drinks, almond or olive oil, emollient fomentations, morphine, stimulants, heat, avoid use of pump.

Incompatibles: Alcohol, alkalies, carbonates, oxides, ferrous sulphate, lead acetate.

CARBON.

$C^{iv} = 12.005.$

The element carbon (L. *carbo*, coal, Skt. *cra*, to cook) in the free state is of the greatest service in its several forms (official, semi-official and non-official), while in combination it is of infinite importance, as it enters into the composition of many medical compounds.

Carbo Ligni. Wood Charcoal, *U.S.P.*—(Syn., Carbo Lig., Charcoal, Vegetable Charcoal, Carbo Præparatus, Carbo e Ligno; Br. Wood Charcoal; Fr. Charbon végétal, Charbon de Bois; Ger. Carbo Ligni pulveratus, Gepulverte Holzkohle, Präparirte Kohle.)

Manufacture: Charcoal is prepared from soft wood (willow, poplar, etc.) by exposure to red heat (300° C.; 572° F.) without access of air, then very finely powdered. In burning wood thus in a retort or under turf, the hydrogen and oxygen are driven off, leaving only carbon; if much air admitted there also will be considerable ash. It is a black, odorless, tasteless powder, very light, non-gritty, burning without luminous flame. *Tests:* 1. Boil for one-half minute 1 Gm. + potassium hydroxide T. S. (3) + distilled water (10)—filtrate only slightly brown. 2. Incinerate—ash 7 p. c. Should be kept in well-closed vessels. Dose, gr. 15–60 (1–4 Gm.).

Preparations.—(Unoff.): *Trochisci Carbonis Ligni*—wood charcoal 30 Gm., tragacanth 4, sucrose 66, vanillin .3, water q. s. 100 troches. *Biscuit. Capsules.* Mostly taken in water.

Properties.—Disinfectants, absorbent, deodorizer, decolorizer. Absorbs gases, condensing them within its pores, especially oxygen. When thus condensed, charcoal has an oxidizing action like ozone, parting readily with its oxygen in the presence of oxidizable sub-

stances. It easily oxidizes H_2S, thus decomposing organic matter when in the dry form.

Uses.—Diarrhea, dyspepsia with fetid breath, gastralgia, pyrosis, diabetes, constipation, nausea, intermittent fevers, worms; large doses purgative. Externally in dressing wounds, ulcers, gangrenous sores, fetid stools in typhoid fever, etc.

Allied Products:

1. *Carbo Animalis Purificatus, Purified Animal Charcoal, Bone, Ivory-black, N.F.*—Charcoal prepared from bone and purified by removing substances dissolved by hot hydrochloric acid and water. Bones are boiled in water to remove fat, then subjected to intense heat without access of air in iron cylinders, the volatile products (gases) escaping through a small opening, the ammoniacal aqueous liquid (bone spirit), a black tar (bone oil) and charcoal residue remaining in the retorts. As such charcoal is a dull black granular, fine powder, odorless, almost tasteless, insoluble in water, alcohol; ignited—grayish ash 85 p. c., soluble in hydrochloric acid by heating; contains carbon 10 p. c., calcium carbonate and phosphate 85–90 p. c. These salts may be removed by boiling gently for 10 hours 100 Gm. with hydrochloric acid 300 Gm., water 600 cc., adding water occasionally to maintain volume, washing and drying residue, thus yielding *Carbo Animalis Purificatus, N.F.*, much richer in carbon. This is also a dull black powder, odorless, tasteless, insoluble in water, alcohol, or other solvents; incinerate—ash 4 p. c. (limit of silica, other inorganic matter). Great absorbent (coloring matter, alkaloids, bitter principles, metallic salts, glucosides, etc.—extracted by boiling in alcohol), poisoning by opium, aconite, strychnine, etc. Dose, gr. 15–60 (1–4 Gm.); for poisoning—give purified charcoal ℥ss (15 Gm.) for each grain (.06 Gm.) of poison (alkaloid, etc.), let remain in stomach 10 minutes, remove by pump or emetic; if longer time allowed reabsorption may take place; 1. *Tabellæ Carbonis Animalis*, $4\frac{3}{5}$ gr. (.3 Gm.) each,—purified animal charcoal 30 Gm. compressed into 100 tablets, using a 9.5 Mm. ($\frac{3}{8}'$) die. Dose, 1–2 tablets.

2. *Carbonei Disulphidum, Carbon Disulphide*, CS_2, U.S.P. 1880–1900.—Obtained by heating charcoal to redness in a vertical cylinder and adding sulphur through a lateral tubule near the bottom; the sulphur melting and vaporizing, combines with the carbon and the carbon disulphide formed distils over through condensing tubes that collect the crude carbon disulphide but allows hydrogen sulphide to escape; it is then agitated with milk of lime, rectified over chlorinated lime solution, litharge, mercury, mercuric chloride, anhydrous copper sulphate, or 2 p. c. of a bland fixed oil, which removes sulphur and disagreeably smelling sulphur compounds. It is a clear, colorless, refractive, diffusive liquid, strong, characteristic, but not fetid odor, sharp, aromatic taste, soluble in alcohol, ether, chloroform, fixed or volatile oils, water (526), sp. gr. 1.256. Anesthetic, rubefacient, antiseptic, anodyne, refrigerant, irritant, poisonous; mostly externally;

opening abscesses, evulsion of nails, headache, toothache, neuralgia, enlarged lymphatics, goiter, lupoid, syphilitic growths, deafness due to lack of nervous energy; solvent for rubber, oils, etc.; internally —gastric cancer (pain), nausea, vomiting, gastralgia, enteric fever. Workmen exposed to its fumes have headache, vertigo, nervousness, voluble talking, incoherent singing, laughing, weeping, weakness, loss of sexual power, impaired vision, hearing, memory, death. *Poisoning:* Powerful narcotic, causing sleep, coma, running, rapid, feeble pulse, stertorous breathing, loss of reflex action, cold, clammy sweat, low temperature, death. Give emetics, potassium bromide, chloral hydrate, stimulants, ammonia inhalation, warmth to body, cold douch to head, artificial respiration. Should be kept cool, remote from lights or fire, in partially filled, well-stoppered bottles or tin cans. Dose, ♏v–15 (.3–1 cc.), well diluted.

Carbonei Tetrachloridum. Carbon Tetrachloride, CCl_4, *U.S.P.*—(Syn., Carb. Tetrachlor., Tetrachlormethane; Carboneum Chloratum, Carbon Perchloride; Fr. Tétrachlorure de Carbone; Ger. Chlorkohlenstoff.)

Manufacture: Pass chlorine into carbon disulphide, containing a small amount of iodine, which acts by catalysis: $CS_2 + 3Cl_2 = CCl_4 + S_2Cl_2$. Carbon tetrachloride is distilled off and the sulphur dichloride purified for use in vulcanizing rubber. It is a clear, colorless, mobile liquid, characteristic, ethereal odor resembling chloroform; non-inflammable (used as a fire extinguisher), decomposed by light if moisture present; soluble in water (2000), miscible with alcohol, chloroform, ether, benzene, petroleum benzin, and dissolves most of the fixed and volatile oils; sp. gr. 1.589, boils at 76.5° C. (170° F.), volatilizes at lower temperatures. Evaporate 50 cc. to 1 cc., then spontaneously to dryness—odorless residue, which heated at 100° C. (212° F.) weighs .001 Gm. *Impurities:* Free chlorine, aldehyde, carbon disulphide, chloride, readily carbonizable substances.

Properties and Uses.—Powerful narcotic but depresses circulation, parasiticide, anesthetic, anthelmintic; valuable for hookworms, where a single dose, ʒss–1 (2–4 cc.), proves a complete cure, without discomfort, excepting an occasional headache, nausea and drowsiness; contraindicated for round-worms, tape-worms and where liver is diseased. Give in soft capsules, each 20 ♏. or in tablespoon, covering medicine with sugar and swallowing at once, on empty stomach; follow 3–4 hours later with magnesium sulphate; do not repeat within 3 weeks, avoid alcohol before and after.

SILICIUM. SILICON.

$Si^{iv} = 28.1.$

The element silicon (L. *silex, silicis*, flint, which is nearly all silica = silicon oxide), like boron, resembles carbon. It is infusible, insoluble, non-volatile, and is met with in crystals as well as amorphous. It

occurs mostly as silicon dioxide (silica), SiO_2—agate, amethyst, chalcedony, flint, quartz, rock crystal, sand, but also as silicates, which are silicic acid having its hydrogen replaced by metals—basalt, feldspar, granite, mica, porphyry, etc. Sodium silicate is the chief medicinal compound, although potassium silicate (fusing together potassium carbonate 10 parts, sand 15, charcoal 1) possesses similar properties.

PREPARATION.—(Unoff.): *Liquor Sodii Silicatis*, U.S.P. 1880–1890. —Made by fusing sand or flint 1 part with dried sodium carbonate 2 parts, lixiviating the product with boiling water, filtering, evaporating. It is a semitransparent, yellowish or greenish viscid liquid, odorless, saline, alkaline, sp. gr. 1.350; contains sodium trisilicate and tetrasilicate 33 p. c., nitric acid precipitates silicic hydroxide. Should be kept in well-stoppered bottles.

PROPERTIES AND USES.—Sodium silicate arrests organic fermentation and putrefaction. Liquor—deodorant, antiseptic, antiferment, astringent, stimulant; chiefly in surgery for fixing bandages in fractures, coating in erysipelas, like collodion, injection in gonorrhea, etc.

Terra Silicea Purificata. Purified Siliceous Earth, *U.S.P.*—(Syn., Ter. Sil. Purif., Purified Kieselguhr, Purified Infusorial Earth, Diatomaceous Earth, Fossil Flour; Ger. Gereinigte Infusorienerde.)

Manufacture: This form of silica, SiO_2, consisting of frustules and fragments of diatoms, is purified by boiling with diluted hydrochloric acid, washing, calcining. It is a very bulky, very fine powder, white, pale gray, pale buff, odorless, tasteless; contains not more than 10 p. c. of water, but readily absorbs moisture, retaining 4 times its weight without becoming fluid; insoluble in water, acids, dilute solutions of alkali hydroxides. *Test:* 1. Digest 1 Gm. with diluted hydrochloric acid 20 cc. for 15 minutes, filter, evaporate to dryness 10 cc., incinerate —residue .005 Gm. *Impurities:* Soluble iron, carbonate, sulphate, moisture, organic substances. Keep in tightly-closed containers.

PREPARATION.—1. *Pasta Zinci Sulphurata, N.F.*, 5 p. c.

PROPERTIES AND USES.—Excipient for pills, dermatologic pastes, containing easily reducible ingredients, potassium permanganate, salts of silver and gold; diluent to hygroscopic powders; filtering medium for obtaining sterile filtrates; preparing dynamite, "putz" pomade and other polishes, packing caustic and inflammable substances.

Talcum Purificatum. Purified Talc, *U.S.P.*—(Syn., Talc. Purif., French Chalk, Creta Gallica, Talc de Venise; Fr. Talc purifié; Ger. Talkstein, Gereinigter Talk.)

Manufacture: Commercial talc (Soapstone, French Chalk), $4MgO.5SiO_2.H_2O$, is a native hydrous magnesium silicate, sometimes with a small amount of aluminum silicate, etc., from which it should be freed, when for pharmaceutical purposes, by boiling for 15 minutes 500 Gm. with boiling water 2500 cc., gradually adding hydrochloric acid 50 cc., allowing to stand for 15 minutes, decanting, rejecting supernatant

liquid (containing the finer particles in suspension), boiling residue in water 2500 cc., mixed with hydrochloric acid 25 cc., allowing to stand for 15 minutes, rejecting liquid, washing residue by repeated decantation until acidity is removed (no opalescence with silver nitrate T. S.), transferring magma to muslin strainer, draining, drying at 110° C. (230° F.). It is a very fine, white, grayish-white powder, entirely free from grittiness, unctuous to the touch, adhering to the skin; odorless, tasteless; ignited at red heat—loses 5 p. c. *Impurities:* Iron, aluminum hydroxide, soluble substances.

PREPARATIONS.—1. *Pulvis Talci Compositus, N.F.*, 87 p. c., + boric acid 10, salicylic acid 3. 2. *Elixir Aromaticum*, 3 p. c. 3. *Liquor Antisepticus, N.F.*, 2 p. c.

PROPERTIES AND USES.—Chiefly as an aid (medium) in filtering, for which a fineness greater than No. 100 is objectionable, as it passes through the filter requiring frequent pouring back; for dusting powder (cosmetic—itching of prickly heat, skin diseases), the No. 60-80 is superior to the finer bolted varieties; native talc for extracting grease, oil spots, marking cloth (tailors), etc.

Related Product:

1. *Pumex, Pumice, Pumice Stone, N.F.*—A substance of volcanic origin, consisting chiefly of complex silicates of aluminum, potassium and sodium; Lépari Islands, Grecian Archipelago, Germany, Nebraska. It occurs in very light, hard, rough porous gray masses (usually floating on water) or gritty, gray-colored powder, permanent, odorless, tasteless; contains silica 60–80 p. c., iron and alumina oxides, 15–20 p. c. + Ca, Mg, Mn, K, Na, traces—same as feldspar, obsidian. *Impurities:* Iron, soluble substances. Aid to comminution, solution, clarification; 1. *Elixir Eriodictyi Aromaticum*, 3 p. c. 2. *Mistura Chloralis et Potassii Bromidi Composita*, 2 p. c. 3. *Tinctura Guaiaci Composita*, .65 p. c.

BORON.

$B^{iii} = 10.9$.

The element boron (L. *bor(ax)* + *on*, fr. Ar. *baraqa*, shine, glisten, substance from which the element first was obtained) resembles carbon very closely. It is infusible, non-volatile, insoluble, and is found sparingly in nature. Occurs as either boric (boracic) acid or sodium borate (borax). Chiefly in Italy and California.

Acidum Boricum. Boric Acid, H_3BO_3, *U.S.P.*—(Syn., Acid. Bor., Boracic Acid, Acidum Boracicum; Fr. Acide borique (crystallisé); Ger. Borsäure.)

Manufacture: Occurs in nature free and combined, but for medicine is prepared usually by dissolving sodium borate (borax) 10 parts in boiling water 24, filtering while hot and adding hydrochloric acid 6; crystallize in a cool place, wash crystals with little cold water to remove adhering acid—$Na_2B_4O_7.10H_2O + 2HCl = 4H_3BO_3 + 2NaCl + 5H_2O$;

yield 5–6 parts. Sulphuric acid may be used for hydrochloric, but adheres more persistently to the boric acid, necessitating two or three recrystallizations. It is in transparent, colorless scales (pearly luster), 6-sided, triclinic crystals, white, bulky powder, slightly unctuous to touch; odorless; faintly bitter taste; permanent, soluble in water (18), boiling water (4), alcohol (18), boiling alcohol (6), glycerin (4); aqueous solution (1 in 50) slightly acid; contains 99.5 p. c. of H_3BO_3. *Tests:* 1. Volatilizes from boiling aqueous or alcoholic solution; dissolve in alcohol, glycerin—green flame. 2. Aqueous solution + little hydrochloric acid T. S.—turns turmeric paper reddish-brown on drying, changed to greenish-black by ammonia water. 3. At 100° C. (212° F.) loses H_2O, forming metaboric acid (hydrogen metaborate, HBO_2), which slowly volatilizes; at 160° C. (320° F.) fuses to glassy mass (tetraboric, pyroboric acid, hydrogen tetraborate, $H_2B_4O_7$); at higher temperature fused mass swells, loses all water and becomes boron trioxide, B_2O_3, which fuses into transparent, non-volatile, hygroscopic mass. *Impurities:* Heavy metals, arsenic, insoluble substances, etc. Dose, gr. 5–30 (.3–2 Gm.).

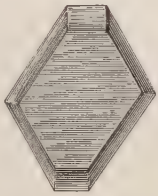


Fig. 446.—Boric acid crystal.

Preparations.—1. *Glyceritum Boroglycerini.* Glycerite of Boroglycerin. (Syn., Glycer. Boroglyc., Glycerite of Glyceryl Borate, Solution of Boroglyceride; Br. Glycerinum Acidi Borici; Fr. Glycéré (Soluté) de Boroglyceride; Ger. Boroglyceridlösung.)

Manufacture: 50 p. c. (glyceryl borate). Heat glycerin 46 Gm. to 150° C. (302° F.), add in portions, constantly stirring, boric acid 31 Gm., when dissolved, evaporate to 50 Gm., frequently stirring and breaking surface film, add glycerin 50 Gm., mix thoroughly—antiseptic. Should be kept in tightly-stoppered bottles.

Prep.: 1. *Suppositoria Boroglycerini, N.F.*, glycerite of boroglycerin 20 gr., glycerinated gelatin 25 gr., glycerin 20 gr., each.

2. *Unguentum Acidi Borici.* Ointment of Boric Acid. (Syn., Ung. Acid. Bor.; Fr. Onguent d'Acide borique; Ger. Borsalbe.)

Manufacture: 10 p. c. Melt yellow wax 5 Gm., add petrolatum 85 Gm., heat gently until liquefied, add gradually warm liquid to boric acid 10 Gm., contained in a warm mortar, triturating thoroughly, stir until congealed.

3. *Cataplasma Kaolini, N.F.*, 4.5 p. c. 4. *Liquor Antisepticus, N.F.*, boric acid 2.5 p. c., thymol $\frac{1}{10}$, eucalyptol $\frac{1}{2}$, methyl salicylate $\frac{1}{8}$, oil of thyme $\frac{1}{33}$, menthol $\frac{1}{10}$, alcohol 30, purified talc 2, water q. s. 100. 5. *Pulvis Antisepticus, N.F.*, boric acid 86.6 p. c., zinc sulphate 12,5, salicylic acid $\frac{1}{2}$, phenol, eucalyptol, menthol, thymol, āā $\frac{1}{10}$.

Properties.—Antiseptic, poisonous.

Uses.—Dyspepsia, restores acidity to ammoniacal urine; externally—conjunctivitis, aphthous ulcers of mouth, diphtheria, vaginitis, otor-

rhea, pharyngitis, burns, ulcers, boils, pruritus, urticaria, eczema, psoriasis, catarrhs, cystitis, gonorrhea, erysipelas, tinea, fetid feet. Trituration with ether facilitates its powdering.

SULPHUR.

$S^{ii} = 32.06$.

The element sulphur (AS, *swefel*, fr. Skt. *culva*, copper, + *ari*, enemy to, or L. *sal*, salt, + Gr. πῦρ, fire, its combustible quality—brimstone, has same meaning, brynstone, burnstone) is found free in volcanic districts, as of Sicily, and universally in combination as sulphates, sulphides, etc. We have several official forms.

Sulphur Sublimatum. Sublimed Sulphur, *U.S.P.*—(Syn., Sulphur Sublim., Flowers of Sulphur, Flores Sulphuris, Brimstone; Fr. Soufre (sublimé), Fleurs (Crême) de Soufre; Ger. Sublimieter Schwefel, Schwefelblüte.)

Manufacture: It is prepared by subliming the crude sulphur and passing the vapors into large condensing chambers, thus leaving behind all earthy impurities save arsenic, which, when present, passes over as arsenic sulphide, also by oxidization during sublimation may have formed sulphurous and sulphuric acids, all of which must be removed. It is a fine, yellow powder, faint odor and taste, practically insoluble in water, nearly so in alcohol, soluble in chloroform (70), ether (150), clive oil (100), incompletely in carbon disulphide (2); contains, when dried to constant weight, 99.5 p. c. of pure sulphur. *Tests:* 1. Heated to 115° C. (240° F.)—fuses to yellow, mobile fluid, which upon further heating becomes dark and viscid. 2. Burns in the air to sulphur dioxide with characteristic odor; volatilize or ignite—residue .5 p. c. Dose, gr. 10–60 (.6–4 Gm.).

Preparations.—1. *Sulphur Lotum.* Washed Sulphur. (Syn., Sulphur Lot.; Fr. Soufre lavé; Ger. Sulfur depuratum, Gereinigter Schwefel (blumen), Flores Sulfuris Loti.)

Manufacture: Pass sublimed sulphur 100 Gm. through a No. 30 sieve, mix in a closed vessel with water 100 cc., add ammonia water 10 cc., set aside for 3 days, agitating occasionally, add water 100 cc., wash on strainer with water until no blue to red litmus paper, drain, press, dry rapidly at moderate heat in a drying closet, pass through No. 30 sieve. This removes acid (sulphuric) impurities and arsenic—$H_2SO_4 + As_2S_3 + 8NH_4OH = (NH_4)_2SO_4 + (NH_4)_3AsO_3 + (NH_4)_3AsS_3 + 5H_2O$. It is a fine, yellow powder, odorless, tasteless, responding to solubility and identity tests of sublimed sulphur; contains, when dried to constant weight, 99.5 p. c. of pure sulphur. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

Preps.: 1. *Pulvis Glycyrrhizæ Compositus*, 8 p. c. 2. *Sulphuris Iodidum, N.F.*, 20 p. c. 3. *Tabellæ Sulphuris et Potassii Bitartratis, N.F.*, 3 gr. (.2 Gm.) each.

2. *Sulphur Præcipitatum.* Precipitated Sulphur. (Syn., Sulphur Præc., Lac Sulphuris, Milk of Sulphur, Magisterium Sulphuris; Fr. Soufre précipité, Magistére (Lait) de Soufre; Ger. Gefällter Schwefel, Schwefelmilch.)

Manufacture: Slake lime (calcium oxide) 50 Gm., mix with water 500 cc., add sublimed sulphur 100 Gm., previously sifted, mix thoroughly, add water 1000 cc., boil for 1 hour, agitating frequently, and replacing evaporated water, let cool and clear by subsidence, draw off, filter, add gradually to clear filtrate, stirring constantly, hydrochloric acid previously diluted with equal vol. of water until liquid nearly neutral, but alkaline and yellow, wash precipitate on strainer until washings are neutral and give no precipitate with ammonium oxalate T. S., dry rapidly.

(1) $3Ca(OH)_2 + S_{12} = 2CaS_5 + CaS_2O_3 + 3H_2O.$
hydroxide, polysulphide, hyposulphite.

(2) $2CaS_5 + CaS_2O_3 + 6HCl = 3CaCl_2 + 3H_2O + S_{12}$, or

(3) $CaS_5 + 2CaS_2O_3 + 6HCl = S_6 + 2H_2O + H_2S + 2SO_2 + 3CaCl_2.$

It is a fine (finer than sublimed sulphur), amorphous powder, pale yellow, neutral, odorless, tasteless, responding to solubility and identity tests of sublimed sulphur, but more soluble in carbon disulphide; residue —.3 p. c.; contains, when dried to constant weight, 99.5 p. c. of pure sulphur. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

Preps.: 1. *Pasta Betanaphtholis, N.F.,* 50 p. c. 2. *Pasta Zinci Sulphurata, N.F.,* 10 p. c.

3. *Unguentum Sulphuris.* Sulphur Ointment. (Syn., Ung. Sulphur.; Fr. Pommade soufree, Pomatum Sulfuratum; Ger. Unguentum Sulfuratum simplex, Schwefelsalbe.)

Manufacture: 15 p. c. Rub sublimed sulphur 15 Gm. with small portion of benzoinated lard until smooth, then incorporate uniformly the remainder, in all 85 Gm.

4. *Liquor Calcis Sulphuratæ, N.F.,* 25 p. c. 5. *Petroxolinum Sulphuratum, N.F.,* 3 p. c. + linseed oil 37, oleic acid 30, liquid petroxolin q. s. 100. 6. *Petroxolinum Sulphuratum Compositum, N.F.,* $\frac{3}{10}$ p. c., sulphurated petroxolin 10 cc., oil of cade 10, thymol .3 Gm., eucalyptol 3 cc., oil of turpentine 30 cc., liquid petroxolin q. s. 100. 7. *Unguentum Sulphuris Alkalinum, N.F.,* 20 p. c., + potassium carbonate 10, water 5, benzoinated lard 65 Gm. 8. *Unguentum Sulphuris Compositum, N.F.,* 15 p. c., + calc. carb. præc. 10, oil of cade 15, soft soap 30, lard 30.

Unoff. Preps.: Confectio Sulphuris (Br.), 45 p. c., ʒj 2 (4–8 Gm.). *Trochiscus Sulphuris* (Br.), each contains precipitated sulphur gr. 5 (.3 Gm.).

Properties.—Alterative, laxative, diaphoretic, resolvent, antiparasitic, stimulant. Much of it passes out of the system unchanged, a small part is converted into sulphides and hydrogen sulphide, this latter being excreted by the breath and skin, gives patients a disagreeable odor, and blackens all silver wearing effects; it increases

peristalsis, making movements softer and more frequent; germicidal effect due to sulphurous acid gas and sulphides formed by decomposition. Sulphides after entering the blood are excreted in the urine as sulphates.

Uses.—Constipation, hemorrhoids, pregnancy, anal fissure, stricture or prolapsus, lead poisoning, chronic rheumatism, gout, bronchitis, asthma. Externally—scabies, diphtheria, sciatica, psoriasis, eczema, acne, sycosis, croup. The *washed* and *precipitated* forms are preferable for internal use, as they contain no arsenic; the latter is best for ointment, owing to its finer division.

Allied Product:

1. *Sulphuris Iodidum. Sulphur Iodide*, S_2I_2, *N.F.*—Obtained by triturating thoroughly together washed sulphur 20 Gm., iodine 80, heating mixture on water-bath at 60° C. (140° F.) until combined (uniform dark color), increasing heat until fused, pouring upon a cold surface; when cold, break into pieces of suitable size. It is a subiodide (disulphide) occurring in brittle masses, crystalline fracture, grayish-black, metallic luster, odor of iodine, acrid taste; almost insoluble in water, soluble in carbon dioxide, glycerin (60); alcohol, ether, or aqueous solution of potassium iodide dissolves the iodine, leaving the sulphur; continued boiling with water vaporizes iodine, leaving 20 p. c. residue (sulphur); on exposure loses iodine, high heat sublimes both elements. Should be kept cool, in glass-stoppered bottles. Stimulant, caustic; substitute for iodine, acne, eczema, tinea capitis, lupus, lepra; locally, ointment, 4 p. c.

Acidum Sulphuricum. Sulphuric Acid, H_2SO_4, *U.S.P.*—(Syn., Acid. Sulphuric., Oil of Vitriol, Vitriolic Acid; Fr. Acide sulfurique, Huile de Vitriol; Ger. Vitriolöl, Schwefelsäure.) A liquid containing 93–95 p. c. of H_2SO_4.

Manufacture: It is made by burning sulphur or pyrites, and oxidizing the SO_2 thus obtained by HNO_3, then passing this sulphuric oxide into steam, whereby sulphuric acid condenses in leaden chambers arranged for the purpose; from these it is drawn off and evaporated to the proper strength. In actual practice the SO_2 is passed over fumes of NO_2 arising from the decomposition of KNO_3 or $NaNO_3 + H_2SO_4$ in the presence of an abundant supply of air. The sulphurous oxide, SO_2, will not take up O to become sulphuric oxide, SO_3, from the air alone, hence this indirect method has to be used; the nitric acid is deoxidized into nitric oxide, and this unites with O of air to form nitric peroxide, while this again supplies fresh O to the sulphurous acid:

(1) $S_2 + O_4 = 2SO_2$. (2) $SO_2 + H_2O = H_2SO_3$. (3) $2NO + O_2 = 2NO_2$. (4) $H_2SO_3 + NO_2 = H_2SO_4 + NO$. (5) $3H_2SO_3 + 2HNO_3 = 3H_2SO_4 + H_2O + 2NO$. (6) $SO_2 + O + H_2O = H_2SO_4$.

In this process five things are evidently necessary: sulphur, nitre (HNO_3), air, watery vapor, heat. It is a colorless, odorless, oily liquid, very caustic, corrosive, strongly acid reaction, even when highly diluted; sp. gr. 1.83, miscible with water or alcohol with evolu-

tion of much heat; must be added with caution to diluents, heated on platinum foil vaporizes with dense white fumes; chars sucrose, wood, many organic substances. *Tests:* 1. Upon 3 cc. pour carefully a layer of ferrous sulphate T. S., cool—zone of contact not brown, reddish-brown (abs. of nitric, nitrous acids). 2. Mixed with alcohol (5)—no precipitate within an hour (abs. of lead). *Impurities:* Heavy metals, lead, arsenic, nitrous and sulphurous acids, nitrate, chloride, non-volatile substances. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 cc.), well diluted.

Preparations.—1. *Acidum Sulphuricum Dilutum.* Diluted Sulphuric Acid. (Syn., Acid. Sulph. Dil.; Fr. Acide sulfurique dilué; Ger. Verdünnte Schwefelsäure.)

Manufacture: Add gradually, stirring constantly, sulphuric acid 10.7 Gm. to distilled water 89.3 Gm., cool; contains 9.5–10.5 p. c. of H_2SO_4. It is a colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.067. *Tests:* 1. With barium chloride T. S.—white precipitate insoluble in hydrochloric acid; others same as for strong acid. *Impurities:* Same as for strong acid. Dose, ♏v–30 (.3–2 cc.), well diluted.

Preps.: 1. *Ferri Carbonas Saccharatus,* q. s. 2. *Ferri Sulphas Granulatus,* q. s. 3. *Infusum Rosæ Compositum, N.F.,* $\frac{9}{10}$ p. c. 4. *Syrupus Rosæ, N.F.,* 1 p. c.

2. *Acidum Sulphuricum Aromaticum.* Aromatic Sulphuric Acid. (Syn., Acid. Sulph. Arom., Elixir of Vitriol, Tinctura Aromatica Acida; Fr. Elixir vitriolique, Teinture (alcoolé) aromatique sulfurique; Ger. Elixir Vitrioli Mynsichti, Saure Aromatischetinktur, Mynsicht's Elixir.)

Manufacture: Add gradually sulphuric acid 10.9 cc. to alcohol 70 cc., cool, add tincture of ginger 5 cc., oil of cinnamon .1 cc., alcohol q. s. 100 cc.; contains free sulphuric acid and ethyl-sulphuric acid equivalent to 19–21 p. c. of H_2SO_4. It is a clear, reddish-brown liquid; pleasant, aromatic odor; strongly acid taste and reaction; sp. gr. 0.94; with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. Should be kept in glass-stoppered bottles. Dose, ♏v–20 (.3–1.3 cc.), well diluted.

3. *Liquor Ferri Tersulphatis,* 9.6 p. c. 4. *Liquor Ferri Subsulphatis, N.F.,* 5.5 p. c. 5. *Oleum Æthereum, N.F.,* q. s.

Properties.—Powerful escharotic, charring black and destroying the parts touched, by abstracting water in the tissues and combining with the albumin; it promotes alkaline secretions, tonic, astringent, poisonous.

Uses.—Diarrhea, hemorrhages, night-sweats, mucous discharges, cholera, quench thirst in fevers, cholera morbus, lead colic, gravel, stone, tape-worms, gastric disorders; chemical antidote in acute lead poisoning. Externally—ulcers, gangrene, cancer, caries of bone, ringworm, scabies (ointment 1 part to 8).

Poisoning: Similar to nitric acid. Give chalk, magnesium oxide or carbonate, alkaline carbonates, demulcent drinks, oils, egg-white, opium for pain, brandy or whisky for collapse; avoid pump.

Allied Product:

1. *Acidum Sulphurosum, Sulphurous Acid*, H_2SO_3, U.S.P. 1860–1900.—This aqueous solution of sulphur dioxide, SO_2, 6.4 p. c., by weight, and water about 94 p. c., is obtained by heating in a flask sulphuric acid 60 cc. and charcoal 20 Gm., passing the evolved gas through a wash-bottle containing water 50 cc., thence into well-cooled distilled water 500 cc., contained in a bottle of 1000 cc. capacity, adding water q. s. to give 6.4 p. c., by weight, of sulphur dioxide. The charcoal acts as a reducing agent upon the sulphuric acid—$C + 2H_2SO_4 = 2SO_2 + 2H_2O + CO_2$; sulphurous acid does not exist in the free state, but undoubtedly is present in solution when sulphur dioxide is passed into water. It is a colorless liquid, characteristic odor of burning sulphur, acid sulphurous taste, volatile, sp. gr. 1.028; exposed to air oxidizes to sulphuric acid of same strength (6.4 p. c.). Antiseptic, germicide, parasiticide, deoxidizant, disinfectant, destructive to plant-life, deodorizer (due to great affinity for oxygen, abstracting it from organic bodies), irritant (SO_2), arrests fermentation, putrefaction by destroying the germs—1 p. c. solution by volume, killing most microörganisms; throat affections locally (spray, mop), diphtheria, chronic bronchitis, tonsillar ulcers, aphthæ, stomatitis, laryngitis, wounds, scabies, thrush, whooping-cough; internally—urticaria, fermentative dyspepsia, flatulence, vomiting (frothy, yeasty). Should be kept cool, dark, in completely-filled, glass-stoppered, amber-colored bottles, and not dispensed unless of full strength (strong odor of burning matches—blue-head). Dose, ℥ss–2 (2–8 cc.), diluted with water; externally, diluted with water, glycerin, or fat.

PHOSPHORUS. PHOSPHORUS, *U.S.P.*

$P^{iii} = 31.04$.

(Syn., Phosphor.; Fr. Phosphore; Ger. Phosphor.)

The element phosphorus (Gr. φῶς, light, + φέρειν, to bring—*i. e.*, emits light in the dark) is official, and occurs in nature combined with various metals (Ca, Fe, Al, etc.), as phosphates, also in plants and animals, constituting about 60 p. c. of all bones in the form of tricalcium phosphate.

Manufacture: It is obtained by treating ground bones with H_2SO_4, when calcium sulphate is precipitated and calcium acid phosphate remains in solution. The latter is evaporated and distilled with sand and charcoal, thereby removing the oxygen and allowing the vaporized phosphorus to distil over, when it is condensed under water.

(1) $Ca_3(PO_4)_2 + 2H_2SO_4 = Ca(H_2PO_4)_2 + 2CaSO_4$.
Tricalcium phosphate. — Calcium acid phosphate

(2) $Ca(H_2PO_4)_2 + \text{heat} = Ca(PO_3)_2 + 2H_2O$.
Calcium metaphosphate.

(3) $2Ca(PO_3)_2 + 2SiO_2 + 10C = 2CaSiO_3 + 10CO + 4P$.

This yellow allotropic form is a translucent, nearly colorless solid, waxy luster, consistence of beeswax (ordinary temperatures), surface, on long keeping, white, red, occasionally black, distinctive and disagreeable odor and taste (use for this only very dilute solution), on exposure emits white fumes, which are luminous in the dark with garlicky odor, on longer exposure often takes fire spontaneously, sp. gr. 1.830, melts at 44° C. (111° F.), soluble in dehydrated alcohol (400), chloroform (40), absolute ether (102), benzene (31.5), carbon disulphide (.9), sparingly in fixed oils, practically insoluble in water, to which it imparts its characteristic odor and taste. *Impurities:* Arsenic, sulphate (both due to sulphuric acid used). Should be kept carefully under water, cool, dark, in strong, well-closed containers. Dose, gr. $\frac{1}{100}$–$\frac{1}{30}$ (.0006–.002 Gm.).

Preparations.—1. *Pilulæ Phosphori.* Pills of Phosphorus. (Syn., Pil. Phosphor.; Fr. Pilules (phosphorées) au Phosphore; Ger. Phosphorpillen.)

Manufacture: Dissolve in test-tube, heating gently, phosphorus .06 Gm. in chloroform 5 cc., replacing from time to time that which evaporates, add this to althea 6 Gm. and acacia 3 Gm., previously mixed, then add mixture of glycerin 2 vols. + water 1, q. s. (4 cc.) for 100 pills; dissolve tolu 10 Gm. in ether 15 cc., and in sufficient quantity of this shake pills until coated, put on a plate, roll occasionally until dry; each pill contains $\frac{1}{100}$ gr. (.0006 Gm.). Should be kept in well-stoppered bottles. Dose, 1–5 pills.

2. *Elixir Phosphori, N.F.*, $\frac{1}{40}$ p. c., + chloroform $\frac{1}{2}$ p. c., alcohol 34, glycerin 30, sp. aurant. co. 1, oil of anise $\frac{1}{5}$, aq. dest. q. s. 100. Dose, ℥ss–2 (2–8 cc.). 3. *Elixir Phosphori et Nucis Vomicæ, N.F.*, tr. nuc. vom. 3.5 p. c., elix. phosphor. q. s. 100. 4. *Liquor Phosphori, N.F.*, $\frac{1}{15}$ p. c., sp. menth. pip. $\frac{1}{2}$ p. c., glycerin 64.50, dehydrated alcohol q. s. 100. Dose, ♏x–15 (.6–1 cc.). 5. *Oleum Phosphoratum, N.F.*, 1 p. c.—phosphorus 1 Gm., ol. amygd. exp. 90, ether q. s. 100 Gm. Dose, ♏j–5 (.06–.3 cc.).

Properties.—Stimulant, tonic, nervine, diaphoretic, irritant, poisonous, nauseant, thickens and renders bones more dense, diminishes tissue-waste. A portion is oxidized into phosphoric acid, and as such enters the blood, some is dissolved by fats and oils that may happen in the stomach, thus being absorbed as phosphorus.

Uses.—Sexual exhaustion, cerebral softening, mania, melancholia, nerve-debility from overwork, worry, typhoid conditions, scarlet fever, measles, chronic eczema, psoriasis, neuralgia, angina pectoris, aphrodisiac, locomotor ataxia.

Poisoning: Have intense intestinal irritation, abdominal pain, scanty urine, vomiting (coffee-ground), diarrhea (rare), constipation (frequent), skin cold, pulse feeble, rapid, syncope, death from exhaustion. Empty stomach, give hydrated magnesia, lime water, charcoal, potassium permanganate, or hydrogen peroxide best antidotes, although French ozanized (old, acid) oil of turpentine and copper sulphate were once considered most valuable—now useless, opium. No oils or fat should

be used, as they dissolve the phosphorus, thus promoting its absorption. It is eliminated mostly by the urine as orthophosphoric acid, increasing excretion of urinary phosphates, hence evacuate bladder frequently.

Synergists: Restoratives, cod-liver oil, arsenic, sulphur.

Acidum Phosphoricum. Phosphoric Acid, H_3PO_4, *U.S.P.*—Syn., Acid. Phos.; Br. Acidum Phosphoricum Concentratum (66.3 p. c.); Fr. Acide phosphorique; Ger. Phosphorsäure.) A liquid containing 85–88 p. c. of H_3PO_4.

Manufacture: It is made by oxidizing phosphorus with diluted nitric acid; the two are heated together in a retort until nitrous fumes cease to be given off, and then concentrated or diluted to desired strength—$5HNO_3 + P_3 + 2H_2O = 3H_3PO_4 + 5NO$; 1 part phosphorus requires 3 parts strong nitric acid, which must be diluted in the process and added gradually, that coming over even being returned to the retort; the final evaporation is in a porcelain dish at 190° C. (374° F.), to drive out nitric acid; should a portion upon dilution remove within a minute the color of potassium permanganate, the product must be heated with additional nitric acid, to reduce phosphorous acid. It is a colorless, odorless, syrupy liquid, strongly acid taste and reaction, even when highly diluted; sp. gr. 1.71; heated loses water; at 200° C. (392° F.) begins to change to pyrophosphoric acid, and at higher temperature is converted into metaphosphoric acid, which volatilizes as dense fumes, or forms on cooling a transparent mass of glacial metaphosphoric acid. *Tests* and *Impurities:* Same as for the diluted acid. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 cc.).

Preparations.—1. *Acidum Phosphoricum Dilutum.* Diluted Phosphoric Acid. (Syn., Acid. Phos. Dil.; Fr. Acide phosphorique médicinal; Ger. Verdünnte Phosphorsäure.)

Manufacture: Mix phosphoric acid 11.6 Gm., distilled water 88.4 Gm.; an aqueous solution containing 9.5–10.5 p. c. of H_3PO_4. It is a clear, colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.057. *Tests:* 1. Supersaturate 3 cc. with ammonia T. S. + magnesium sulphate T. S. (or magnesia mixture T. S.)—white, crystalline precipitate, which collected, washed and dissolved in diluted acetic acid, + silver nitrate T. S.—yellow precipitate (dist. from metaphosphoric, pyrophosphoric acids). 2. Warm gently 5 cc., + 2 cc. of silver nitrate T. S.—not brown (abs. of phosphorous, hypophosphorous acids). *Impurities:* Heavy metals, arsenic, phosphates, metaphosphoric, pyrophosphoric, hydrochloric, phosphorous, hypophosphorous acids, sulphate, nitrate. Should be kept in well-stoppered bottles. Dose, ♏v–30 (.3–2 cc.), well diluted.

2. *Elixir Calcii et Sodii Glycerophosphatum, N.F.,* $\frac{4}{5}$ p. c. 3. *Elixir Calcii Lactophosphatis, N.F.,* 1.5 p. c. 4. *Elixir Gentianæ Glycerinatum, N.F.,* $\frac{1}{2}$ p. c. 5. *Liquor Phosphatum Acidus, N.F.,* 12 p. c. 6. *Liquor Phosphatum Compositus, N.F.,* 10.6 p. c. 7. *Syrupus Calcii Lactophosphatis, N.F.,* 3.6 p. c. 8. *Syrupus Ferri, Quininæ et Strychninæ Phosphatum, N.F.,* 5 p. c.

Phosphoric acid when heated above 300° C. (572° F.) parts with its water, becoming glacial phosphoric acid (*Acidum Metaphosphoricum*)—H_3PO_4 + heat = HPO_3 + H_2O, which occurs in sticks or glassy lumps, hygroscopic; contains sodium metaphosphate and pyrophosphoric acid, readily soluble in water, gradually changing into phosphoric acid, coagulates egg-albumen.

PROPERTIES.—Tonic, alterative, refrigerant.

USES.—Dyspepsia, hysteria, diabetes, leucorrhea, low fevers, scrofula, caries of bone, night-sweats, catarrhal affections, jaundice, melancholia, injection for sinuses, scrofulous joints, wash for ulcers, preparation of oxyphosphate of zinc cement (dentistry).

Acidum Hypophosphorosum. Hypophosphorous Acid, HPH_2O_2, *U.S.P.*—(Syn., Acid. Hypophos.; Fr. Acide Hypophosphoreux; Ger. Unterphosphorigesäure.) An aqueous solution containing 30–32 p. c. of HPH_2O_2.

Manufacture: Dissolve calcium hypophosphite 138 Gm. in boiling water 900 cc., add oxalic acid 103 Gm. dissolved in boiling water 400 cc.; boil mixture, evaporate filtrate to 358 Gm.—$Ca(PH_2O_2)_2 + H_2C_2O_4 = 2HPH_2O_2 + CaC_2O_4$; a weaker acid may be obtained by dissolving potassium hypophosphite (208) in water (588), tartaric acid (300) in diluted alcohol (600), mix, cool, filter—$KPH_2O_2 + H_2C_4H_4O_6 = HPH_2O_2 + KHC_4H_4O_6$. It is a colorless, slightly yellow, odorless liquid; intensely acid taste and reaction, even if highly diluted; sp. gr. 1.130; when heated water evaporates, and at 135° C. (275° F.) decomposes, forming spontaneously hydrogen phosphide (which ignites) and phosphorous acid, the latter decomposing at 165° C. (329° F.) into hydrogen phosphide and phosphoric acid; at higher temperature the pasty residue reddens, ignites, burning out unoxidized phosphorus. *Tests:* 1. With mercuric chloride T. S.—white precipitate, gray with excess. 2. Neutralize 30 cc. of a dilution (1 in 3) with ammonia T. S.—only slight precipitate. *Impurities:* Heavy metals, arsenic, barium, oxalate. Dose, ♏iij–20 (.2–1.3 cc.).

PREPARATIONS.—1. *Acid Hydriodicum Dilutum*, 2 p. c. 2. *Syrupus Ferri Iodidi*, ½ p. c. 3. *Liquor Hypophosphitum Compositus, N.F.*, $\frac{7}{10}$ p. c. 4. *Syrupus Ammonii Hypophosphitis, N.F.*, $\frac{1}{10}$ p. c. 5. *Syrupus Calcii et Sodii Hypophosphitum, N.F.*, $\frac{1}{7}$ p. c. 6. *Syrupus Calcii Hypophosphitis, N.F.*, $\frac{1}{7}$ p. c. 7. *Syrupus Hypophosphitum, N.F.*, $\frac{1}{10}$ p. c. 8. *Syrupus Hypophosphitum Compositus, N.F.*, ½ p. c.

Unoff. Prep.: Acid Hypophosphorosum Dilutum, 10 p. c., ♏x–60 (.6–4 cc.).

PROPERTIES AND USES.—Tonic, mostly in combination with strychnine, quinine, iron; nervous debility. In pharmacy as a reducing agent in analysis, and as a preservative to prevent decomposition of iodides in solution when exposed to light and air. An acid of 50 p. c. is also made by evaporating carefully the 30 p. c. acid to three-fifths of its weight, or the 10 p. c. acid to one-fifth of its weight, sp. gr. 1.406.

Halogens or *Haloids.*—Chlorine, Bromine, Iodine, Fluorine. This group of four elements is one of very great importance in medicine and pharmacy. The word halogen is from Gr. ἅλις, the sea, in reference to their original source; thus chlorine is from sea-salt, bromine from sea-water, and iodine from seaweed; besides this they all have atomic weights of a common ratio—chlorine, 35.46; bromine, 79.92; iodine, 126.92; fluorine, 19, which compared with the last is as 1, 7, 4, 2, or 35.4 + 126.9 ÷ 2 gives 81, which is approximately the atomic weight of bromine. In addition, they possess strong chemical affinities and enter into the composition of a large number of useful compounds.

CHLORINE.

$Cl^i = 35.46.$

The element chlorine (Gr. χλωρός, light green—*i. e.,* color of the gas) is a greenish-yellow irrespirable gas, and as such is mainly useful as a reagent in the laboratory and for bleaching, deodorizing, or disinfecting. It is not official, but some of its compounds are.

Preparation.—1. *Liquor Chlori Compositus,* Chlorine Water, *N.F.*—To potassium chlorate .6 Gm. in a 200 cc. flask, having tightly-fitting stopper with small glass tube and funnel tube with stop-cock, add hydrochloric acid 2 cc., diluted with distilled water 2 cc., close stop-cock, place flask on water-bath until solution effected and flask filled with greenish-yellow gas; remove flask from water-bath, add cold distilled water, in several portions, agitating thoroughly after each addition, q. s. 100 cc.—$2KClO_3+4HCl=2KCl+2H_2O+2ClO_3+Cl_2$. It is a yellow liquid, strong odor and taste of chlorine; 1 drop added to 5 cc. potassium iodide T. S.—liberates iodine; evaporated to dryness—white residue (potassium chloride). Should only be dispensed when fresh and in well-filled, amber-colored bottles. Stimulant, antiseptic, disinfectant, irritant; typhus fever, liver affections, blood poisoning, scarlatina, fetid bronchitis, diphtheria, typhoid diarrhea, dysentery, smallpox, phthisis; externally (well diluted)—gargle in smallpox, scarlet fever, putrid sore throat, wash for ulcers, cancers, buboes, abscesses, itching in skin diseases; chronic catarrh—in atomizer: ℥ss; 2 cc., hot water ℥j; 30 cc.

Poisoning: When inhaled may have laryngeal irritation, edema, asphyxia, black eschars, cough, sensation of constriction across chest, difficult deglutition; when swallowed, have burning sensation, possibly perforations of esophagus and stomach. Inhale ammonia vapor, steam, fresh air, ether, chloroform; emetic, warm water, albumen (white of egg), milk, flour, lime water, stimulants, opium. *Incompatibles:* Salts of lead and silver. Dose, ℥ss–1 (2–4 cc.).

Chloramina. Chloramine, $[C_6H_4(CH_3)(SO_2NNaCl).3H_2O]$, *U.S.P.*—(Syn., Chloram., Sodium Paratoluenesulphonchloramide, Chloramine-T., Chlorazene, Tolamine, Tochlorine; Ger. Chloramin, Mianin).

Manufacture: Convert toluene into toluene-para-sulphonic acid, treat resulting sodium salt with phosphoric pentachloride getting toluene-para-sulphonic chloride—an abundant by-product in producing gluside (saccharin), which also can be the starting-point; treat this with ammonia under pressure to form toluene-para-sulphonamide, which acted upon with sodium hypochlorite, in presence of an alkali, gives a solution from which it crystallizes—then recrystallize twice from hot water and dry. It is in white, faintly yellow crystals, crystalline powder, slight chlorine odor, slowly decomposes on exposure, losing chlorine; soluble in water (7), boiling water (2), insoluble in benzene, chloroform, ether, decomposed by alcohol; at 95–100° C. (203–212° F.) loses water of crystallization without decomposition. *Tests:* 1. Aqueous solution (1 in 20) alkaline, + potassium iodide T. S.—liberates iodine, whereas alkali bromides fail to liberate bromine unless acidulated (dif. from dichloramine). 2. Aqueous solution + acids—white turbidity or precipitate, redissolved in excess of alkali hydroxide solution; when strong mineral acids used—chlorine also liberated; contains 11.5–13 p. c. of active chlorine. *Impurities:* Dichloramine, readily carbonizable substances. Should be kept dark, in well-closed containers.

Properties and Uses.—Antiseptic, germicide, surgical disinfectant, depressant, poisonous. Its value established by Dr. Dakin, 1915, and has advantages over sodium hypochlorite in that the solutions are more stable and less irritating to the tissues; compares favorably with phenol and mercuric chloride, but action lessened where there is much necrotic tissue to dissolve; to irrigate superficial and deep wounds, antiseptic wash for mouth, bladder, uterus and other cavities. Decomposed by secretions of stomach, but, protected therefrom, is a valuable intestinal antiseptic. Solution, $\frac{1}{2}$–4 p. c. usually employed; also paste, $\frac{1}{2}$–1 p. c., + neutral sodium stearate 8.6 p. c., + water q. s., which should be freshly prepared.

Dichloramina. Dichloramine, $[C_6H_4(CH_3)(SO_2NCl_2)]$, *U.S.P.*—(Syn., Dichloram., Paratoluenesulphondichloramide, Dichloramine-T.)

Manufacture: Shake on a shaker for one-half hour, chlorinated lime 350–400 Gm. with water 2 L., allow to settle; add to filtrate powdered toluene-parasulphonamid 75 Gm., shake until dissolved, filter, acidify (acetic acid), extract with chloroform, dry chloroform solution over calcium chloride, let filtrate evaporate in the air; if necessary may recrystallize. It is in pale yellow crystals, yellowish, crystalline powder, chlorine odor, gradually decomposed by kerosene, olive oil, and on exposure loses chlorine; soluble in eucalyptol, chlorinated paraffin hydrocarbons, glacial acetic acid, benzene (1), chloroform (1), carbon tetrachloride (2.5), almost insoluble in water, decomposed by alcohol; melts at 80° C. (176° F.). *Tests:* 1. Add .1 Gm. to 5 cc. aqueous solution of sodium bromide (1 in 10)—bromine liberated (dif. from chloramine). 2. Strong mineral acids—liberate chlorine; 1 Gm. dissolves in chloroform 5 cc.; contains 28–32 p. c. of active chlorine, and

is the acid of which chloramine is the sodium salt—differing from it in being insoluble in water, and soluble in eucalyptol, liquid petrolatum, etc. *Impurities:* Chloramine, readily carbonizable substances. Should be kept dark, in well-closed containers.

PROPERTIES AND USES.—Similar to chloramine—disinfectant, antiseptic, germicide; oily solution (1 in 2000) destroys *Bacil'lus typho'sus*—8 times stronger than phenol; valuable in infected wounds being less irritating to surrounding healthy skin than other disinfectants, nose, throat, eye; efficient dressing in burns as the oily solvent renders changing painless, while being actively antiseptic. Solution for surgery—2–10 p. c., mucous membranes—$\frac{1}{2}$–2 p. c.

Acidum Hydrochloricum. Hydrochloric Acid, HCl, *U.S.P.*—(Syn., Acid. Hydrochl., Muriatic Acid, Spirit of (Sea) Salt, Marine Acid, Acidum Chlorhydricum, Chlorhydric Acid; Fr. Acide hydrochlorique—chlorhydrique—muriatique; Ger. Salzsäure, Chlorwasserstoffsäure.) An aqueous solution containing 31–33 p. c. of HCl.

Manufacture: Heat sodium chloride with sulphuric acid, wash evolved HCl gas and pass it into cold water—(1) $2NaCl + H_2SO_4 = 2HCl + Na_2SO_4$. (2) $NaCl + H_2SO_4 = HCl + NaHSO_4$. The latter equation is mostly used, as less heat is required and the more soluble sulphate formed is easily washed out from the retorts with a stream of water. Much crude acid is produced in the Lablanc soda factories, where sodium chloride and sulphuric acid are heated in cylinders to obtain sodium sulphate (salt cake), the first step in making sodium carbonate. It is a colorless, fuming liquid; pungent odor; strongly acid taste and reaction, even when highly diluted; fumes and odor disappear on adding water (2); sp. gr. 1.155; heated with manganese dioxide—evolves chlorine. *Tests* and *Impurities:* Same as for the diluted acid. Should be kept in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 cc., well diluted.

Fuming hydrochloric acid contains 38.2 p. c. of HCl, is colorless, fuming strongly in the air, sp. gr. 1.195, used chiefly in chemical processes.

PREPARATIONS.—1. *Acidum Hydrochloricum Dilutum.* Diluted Hydrochloric Acid. (Syn., Acid. Hydrochl. Dil., Diluted Muriatic Acid; Fr. Acide chlorhydrique dilué; Ger. Verdünnte Salzsäure.)

Manufacture: Mix hydrochloric acid 31.3 Gm., distilled water 68.7 Gm. It is a colorless, odorless liquid, strongly acid taste and reaction; sp. gr. 1.049; contains 9.5–10.5 p. c. of HCl. *Tests:* 1. With silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. 2. Evaporate 25 cc.—residue .003 Gm. *Impurities:* Heavy metals, arsenic, free bromine, free chlorine, bromide, iodide, sulphates, sulphuric, sulphurous acids. Should be kept in glass-stoppered bottles. Dose, ♏v–30 (.3–2 cc.), well diluted.

Preps.: 1. *Liquor Acidi Arsenosi*, 5 p. c. 2. *Fluidextractum Ipecacuanhæ*, 15 p. c. 3. *Elixir Chloridorum, N.F.*, 8.3 p. c. 4.

Elixir Pepsini, N.F., $\frac{2}{5}$ p. c. 5. *Extractum Conii, N.F.*, $\frac{3}{10}$ p. c., 6. *Glyceritum Pepsini, N.F.*, $\frac{1}{2}$ p. c. 7. *Liquor Pepsini, N.F.*, $\frac{1}{2}$ p. c. 8. *Liquor Pepsini Antisepticus, N.F.*, $\frac{1}{2}$ p. c. 9. *Liquor Pepsini Aromaticus, N.F.*, $\frac{1}{2}$ p. c.

2. *Resina Podophylli*, 1 p. c. 3. *Fluidextractum Sanguinariæ, N.F.*, 5 p. c. 4. *Liquor Chlori Compositus, N.F.*, 2 p. c. 5. *Tinctura Sanguinariæ, N.F.*, 1 p. c.

PROPERTIES.—Tonic, refrigerant, antiseptic, irritant, poisonous. Given before meals checks flow of gastric juice, diminishing acidity, but 2–3 hours after food increases the acidity; acts as gastric antiseptic, being in the gastric juice .2 p. c., aiding in the conversion of pepsinogen into pepsin, and of proteins into peptones; increases saliva, bile, pancreatic juice, checks fermentation, cleans tongue, allays thirst, combines with albumin or alkaline base of blood, lessening its alkalinity; prolonged use impairs digestion, constipates. The strong applied to the skin produces a blister, destroys tissue, whitens mucous membranes, causing necrosis and sloughing.

USES.—Low fevers, phthisis, syphilis, phosphatic deposits, acid dyspepsia, gastro-intestinal indigestion without diarrhea (after meals), chronic gastric catarrh, gastric cancer, to quench thirst, skin diseases (eczema, psoriasis), diphtheria, stomatitis.

Poisoning: Similar to nitric acid. Give alkalies, magnesium oxide, sodium bicarbonate, soap, demulcent drinks, albumen, oil, milk; opium for pain, brandy or whisky for collapse.

Incompatibles: Oxidizable substances (explosive), alkalies, carbonates, salts of Ag, Ca, Pb, glucosides.

Synergists: Digestive ferments, vegetable bitters, gentian, nux-vomica, etc.

BROMUM. BROMINE, *N.F.*

$Br^i = 79.92.$

(Syn., Brominium; Fr. Brôme; Ger. Brom.)

The element bromine (Gr. *βρῶμος*, bad smell, stink—*i. e.*, its disagreeable odor), owing to powerful corrosive irritant properties, is employed seldom in the free state, but in combination with the metals, forming salts that are sedative; it is of great service in medicine. Obtained from sea-water, which contains $\frac{1}{175}$ p. c., by evaporating until most of the salts crystallize out, leaving bromides; or from mother-liquor (bittern) of salt-works, which contains bromides (chiefly of magnesium) by heating and passing chlorine into it, condensing the volatilized bromine under water—$MgBr_2 + Cl_2 = MgCl_2 + Br_2$. It is a heavy, brownish-red, mobile liquid, evolving always reddish irritating, suffocating fumes, odor of chlorine, sp. gr. 3.1, boils at 63° C. (145° F.), soluble in alcohol, ether, chloroform, carbon disulphide, water (90). Destroys color of litmus or indigo solutions, imparts yellow color to starch T. S.; contains not less than 99 p. c. of Br. and not more than 1 p. c. of Cl. *Impurities:* Organic bromine compounds,

iodine, chlorine. Powerful caustic, disinfectant, germicide; internally: scrofula, syphilis; externally: weak solution (ʒss—Oj water) ulcers, gangrene, etc.; vaporized—effective poison-gas in warfare. *Poisoning:* Burning pain along entire alimentary tract, vomiting, purging, collapse, death, perforation may result; give ammonia water (diluted with water or olive oil), demulcents, opium, atropine, strychnine, external heat. Should be kept cool, dark, in glass-stoppered bottles, each of which should be enclosed in a larger vessel with intervening space filled with a substance to absorb and combine with any escaping vapors.

Related Products:

1. *Acidum Bromauricum. Bromauric Acid,* $HAuBr_4.5H_2O$, *N.F.*—Obtained by acting on gold powder with bromine, and, when reaction over, adding hydrobromic acid, sp. gr. 1.380, equal to quantity of gold present, and then again bromine until gold dissolved. Occurs in dark red-brown flat, needle-shaped crystals, or irregular coarse, granular masses; odorless, metallic acid taste, permanent when pure, deliquescent when chloride present; melts at 27° C. (81° F.); with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, slightly soluble in ammonia water; contains 32 p. c. of gold. *Impurities:* Chloride, etc. Alterative (resolvent), nervine, tonic, sedative, blood purifier; diabetes, etc. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.); 1. *Liquor Auri Bromidi et Arseni,* $\frac{1}{3}$ p. c., bromauric acid .325 Gm., bromine $\frac{2}{5}$, arsenic trioxide $\frac{1}{4}$, aq. dest. q. s. 100 cc. Dose, ♏ij–5 (.13–.3 cc.).

2. *Acidum Hydrobromicum Dilutum, Diluted Hydrobromic Acid,* U.S.P. 1880–1910.—Made by pouring diluted sulphuric acid into a hot saturated solution of potassium bromide, and after 24 hours (potassium sulphate having crystallized out) distil the liquid in a glass retort—$2KBr + H_2SO_4 = 2HBr + K_2SO_4$; or pass H_2S into bromine and water—$10Br + 2H_2S + 4H_2O = 10HBr + H_2SO_4 + S$; or dissolve tartaric acid (10) and potassium bromide (8), each in cold distilled water (25), add acid solution to saline, shake, cool 24 hours (ice-water, ice-chest), filter—$KBr + H_2C_4H_4O_6 = HBr + KHC_4H_4O_6$; here is formed acid potassium tartrate which upon standing crystallizes out, leaving a supernatant 15 p. c. solution of hydrobromic acid. It is a colorless, odorless liquid; strongly acid taste and reaction; sp. gr. 1.076. Pure hydrobromic acid is a colorless gas, having pungent irritating odor, producing, in a damp atmosphere, dense white fumes, sp. gr. 2.797; on distilling this once official solution—water and weak acid first pass over, and at 126° C. (259° F.) the strongest solution (acid) obtainable remains, 47.8 p. c., which may be distilled unchanged; an acid (solution) of 34 p. c. also is marketed. Sedative, narcotic, small doses stimulant, similar to potassium bromide, but with less depression; epilepsy, nervousness, headache, tinnitus aurium, vomiting, whooping-cough, muscular spasms, neuralgia, bronchial coughs, cerebral hyperemia, insomnia, irritable heart. Dose, ʒss–1 (2–4 cc.), in water or flavored syrup.

Carbromalum. Carbromal, $[C(C_2H_5)_2Br.CONH.CONH_2]$, *U.S.P.*—(Syn., Carbrom., Bromdiethylacetylurea, Bromdiethylacetyl carbamide; Ger., Adalin, Bromdiäthylazetylkarbamid.)

Manufacture: Convert diethyl acetic acid into a bromine derivative, $(C_2H_5)_2CBr.COBr$, bromo-diethyl-acetyl-bromide, then effecting reaction between this and urea. It is a white, crystalline, odorless powder, soluble in water (3000), alcohol (18), chloroform (3), ether (14), very soluble in boiling alcohol; dissolves in sulphuric, nitric or strong hydrochloric acids from which it is precipitated by water; dissolved by solutions of alkali hydroxides; melts at 117° C. (243° F.); ash—negligible; contains 36 p. c. of combined bromine. *Tests:* 1. Boil .2 Gm. with 5 cc. of a 10 p. c. aqueous sodium hydroxide solution—ammonia evolved. 2. Mix .1 Gm. with .5 Gm. anhydrous sodium carbonate, ignite gently until decomposed; dissolve residue in hot distilled water 5 cc., cool, acidulate with acetic acid, add to filtrate chloroform 2 cc., then chlorine T. S. drop by drop—chloroform red-brown on shaking. *Impurities:* Chloride, sulphate, readily carbonizable substances, etc. Dose, nerve sedative, gr. 5–10 (.3–.6 Gm.); hypnotic, gr. 10–15 (.6–1 Gm.).

Properties and Uses.—Hypnotic, somnificant, sedative, analgesic; insomnia (inferior to barbital), hysteria, epilepsy, neurasthenia, neuralgia, pain, whooping-cough. Safe and reliable; recovery has been made from 45 gr. (3 Gm.) after 60 hours of narcosis.

IODUM. IODINE, *U.S.P.*

$I^i = 126.92$.

(Syn., Iodinium; Fr. Iode; Ger. Jodum, Jod.)

The element iodine (Gr. ἴον, violet, + εἶδος, form, likeness—*i. e.*, from its violet-colored vapor) is official, and occurs in nature combined with the metals sodium, potassium, magnesium, etc.

Manufacture: An important source is the ash (kelp) of seaweeds (kelps) which contains about $\frac{1}{2\,0\,4}$ of its weight of iodine; the weeds are dried, burnt at the lowest possible temperature, ash exhausted with hot water, solution filtered, evaporated, cooled, when the less soluble salts—potassium chloride, sodium carbonate, and sulphate crystallize out; to mother-liquor, containing sodium and magnesium iodides, heated in lead retorts to 60° C. (140° F.) manganese dioxide and sulphuric acid are added, when iodine distils over, being collected in glass receivers—$2NaI + 3H_2SO_4 + MnO_2 = I_2 + 12NaHSO_4 + MnSO_4 + 2H_2O$. Much iodine is now obtained in Chile from the mother-liquor of saltpetre, containing about 22 p. c. of sodium iodate, by treating it with sulphurous acid—$2NaIO_3 + 5H_2SO_3 = Na_2SO_4 + 4H_2SO_4 + I_2$; the liberated iodine is filtered or distilled off, and may be purified by mixing with potassium iodide and subliming. It is in heavy, bluish-black, brittle, rhombic plates, metallic luster, distinctive odor, sharp, acrid taste, sp. gr. 4.66, imparts deep brown, evanescent stain to the

skin, slowly destroys vegetable colors; soluble in chloroform, ether, carbon tetrachloride, aqueous solutions of iodides, carbon disulphide (4), alcohol (12.5), glycerin (80), water (2950); solution in alcohol or aqueous solution of potassium iodide—reddish-brown color; solution (1 in 1000) in chloroform, carbon tetrachloride or carbon disulphide—violet color; contains 99.5 p. c. of iodine. *Tests:* 1. Volatilizes slowly at ordinary temperatures; fumes at 114° C. (237° F.), gradually dissipating in violet vapor, leaving residue .05 p. c. 2. Saturated aqueous solution + starch T. S.—blue color, discharged on boiling, but reappears upon cooling. *Impurities:* Chloride, bromide, cyanogen. Should be kept cool, in glass-stoppered bottles. Dose, gr. $\frac{1}{4}$–1 (.016–.06 Gm.).

PREPARATIONS.—1. *Liquor Iodi Compositus.* Compound Solution of Iodine. (Syn., Liq. Iodi Co., Lugol's Solution; Br. Tinctura Iodi Fortis, Strong Tincture of Iodine, Liniment of Iodine, Liquor Iodinii Compositus; Fr. Soluté ioduré de Lugol; Ger. Lugolsche Jodlösung.)

Manufacture: 5 p. c. Dissolve iodine 5 Gm., potassium iodide 10 Gm., in distilled water q. s. 100 Gm. It is a transparent liquid, deep brown, iodine odor; aqueous solution containing 4.8–5.2 p. c. of iodine, and 9.8–10.2 p. c. of potassium iodide. *Test:* 1. Add 1 drop to 1 cc. of starch T. S. diluted with water 10 cc.—deep blue color. Should be kept dark, in glass-stoppered bottles. Dose, ♏j–10 (.06–.6 cc.); mostly used externally.

Prep.: 1. *Liquor Iodi Phenolatus*, Carbolized Solution of Iodine, *N.F.*, 1.5 cc., + phenol liq. $\frac{3}{5}$ cc., glycerin 16.5, water q. s. 100.

2. *Tinctura Iodi.* Tincture of Iodine. (Syn., Tr. Iodi, Tinctura Iodinii; Fr. Teinture d'Iode; Ger. Jodtinktur.)

Manufacture: 7 p. c. Dissolve potassium iodide 5 Gm. in distilled water 5 cc., add iodine 7 Gm., agitate until solution effected, add alcohol q. s. 100 cc., mix thoroughly. It is an alcohol solution of iodine, 6.5–7.5 Gm., and potassium iodide, 4.5–5.5 Gm., in the 100 cc. Dose, ♏j–5 (.06–.3 cc.); mostly used externally.

3. *Unguentum Iodi.* Iodine Ointment. (Syn., Ung. Iodi, Unguentum Iodinii; Fr. Pommade d'Iode; Ger. Jodsalbe.)

Manufacture: 4 p. c. Triturate until dissolved iodine 4 Gm., potassium iodide 4 Gm., glycerin 12 Gm., in a glass mortar, gradually incorporate wool fat 80 Gm., mix thoroughly; avoid metallic utensils and containers, and only dispense when freshly made.

4. *Ampullæ Iodi*, Iodine Swabs, *N.F.*, 3.5 p. c., + pot. iod. 2.5, aq. dest. 30, alcohol q. s. 100. 5. *Dentilinimentum Aconiti et Iodi Compositum*, *N.F.*, 2.2 p. c. 6. *Liquor Iodi et Zinci Phenolsulphonatis*, *N.F.*, 20 p. c., + pot. iod. 15, zinci. phenolsulph. 15, glycerin 25, aq. dest. q. s. 100. 7. *Petroxolinum Iodi*, *N.F.*, 10 p. c. 8. *Petroxolinum Iodi Dilutum*, *N.F.*, 5 p. c. 9. *Phenol Iodatum*, *N.F.*, 20 p. c. 10. *Syrupus Iodotannicus*, *N.F.*, iodine .27 Gm., acid. tan. .54 Gm., sucrose 80, aq. dest. q. s. 100 cc. Dose, ʒss–1 (2–4 cc.). 11. *Tinctura Iodidorum*, Decolorized Tincture of Iodine, *N.F.*, iodine 5 Gm., pot. iod. 2.5, aq. ammon. fort. 10 cc., water 40, alcohol q. s. 100 cc. 12. *Tinctura Iodi*

Fortior, Churchill's Tincture of Iodine, *N.F.*, iodine 16.5 Gm., pot. iod. 3.5, water 25 cc., alcohol q. s. 100 cc. 13. *Unguentum Iodi Denigrescens*, Stainless Iodine Ointment, *N.F.*, iodine 5 Gm., paraffin 5, oleic acid 20, petrolatum 70.

PROPERTIES.—Antiseptic, counter-irritant, causing itching, smarting of the skin, corrosive, alterative, absorbent. Rapidly absorbed by mucous membranes, in the blood combined with sodium; eliminated in urine, saliva, milk, by intestinal and nasal mucous membranes.

USES.—Mostly external; enlarged glands, chronic abscesses, swollen joints, chilblains, ringworm, chronic pneumonia, lung affections, boils, carbuncles, suppurating glands, hydrocele, ovarian cyst, hernia, dropsy of the joints, large chronic bronchocele, chronic abscesses, fistulæ, wounds of venomous serpents, bites of rabid animals, hydrocephalus, chronic dysentery, diarrhea.

Poisoning: Have metallic taste, pain in throat and stomach, salivation, intense thirst and gastro-enteritis, vomiting, purging, pale face, suppressed urine, vertigo, faintness, feeble and rapid pulse, fever, cyanosis, swollen eyelids, convulsive movements, collapse. Give emetics, starch, flour, arrowroot mixed with water, induce vomiting, sodium bicarbonate, hypodermic ammonia, stimulants (strychnine, digitalis, alcohol, atropine), morphine, demulcents, heat.

Incompatibles: Ammonia, mineral acids, metallic salts, alkaloids, forming insoluble compounds with most of these. Iodides with mineral acids, acid salts, bismuth subnitrate, alkaloids, silver nitrate, soluble lead salts, potassium chlorate, spirit of ethyl nitrite, glycyrrhiza.

II. METALS AND THEIR COMPOUNDS (SALTS).

These are treated also in natural groups, which associate those together having the strongest points of relationship. Thus in regular sequence we have;

LIGHT METALS.

Alkali Metals. K, Na, Li, (NH_4). Oxides, carbonates, and most salts soluble.

Alkaline Earth Metals. Ba, Ca, Sr, (Mg). Oxides soluble, carbonates insoluble.

Earth Metals. Al, and some rare metals. Oxides insoluble.

HEAVY METALS.

Iron Group. Fe, Co, Ni, Mn, Cr, U, Zn. Sulphides soluble in dilute acids.

Lead Group. Cd, Pb, Cu, Bi, Ag, Hg.

Arsenic Group. As, Sb, Sn, Au, Pt, Mo.

Sulphides insoluble in dilute acids.

Sulphides insoluble in ammonium sulphide.

Sulphides soluble in ammonium sulphide.

POTASSIUM (KALIUM).

$K^i = 39.1$.

Potassium (L. for potash—*pot* + *ash*—*i.e.*, origin of the salts by evaporating wood-ash lye in pots; Ar. *kali*, L. *kalium*, ashes) occurs in nature to a great extent as a double silicate of potassium and aluminum

(granitic rocks, feldspar, etc.), also as chloride, nitrate, bitartrate, and carbonate, the latter being the predominant salt in wood-ashes. The metal is obtained by heating this carbonate with carbon in iron retorts, passing the evolved vapors into coal-oil in order to condense the metal —$K_2CO_3 + 2C = 2K + 3CO$. Plants derive much of their potassium from these disintegrated rocks, containing the silicate, which is absorbed by falling rain; this percolates through the soil, and from that the plant-roots (rootlets, trichomes) in turn take it. Potassium occurs also in native wood, chiefly as the acetate, but to some extent as sulphate, chloride, tartrate, citrate, etc., most of which upon incineration become converted into the carbonate.

Tests for Potassium Salts: 1. With platinic chloride, alcohol and HCl, get a yellow crystalline precipitate ($PtCl_42KCl$). 2. With strong solution of tartaric acid, get a white crystalline precipitate of cream of tartar—alcohol facilitates the precipitation. 3. The flame of a Bunsen burner is colored violet, which can be recognized, even though sodium be present, through the intervention of blue glass or indigo solution. 4. Potassium salts are soluble in water, non-volatile, and usually white.

Potassii Carbonas. Potassium Carbonate, K_2CO_3, *U.S.P.*—(Syn., Pot. Carb., Salt of Tartar, Carbonas Potassicus (Kalicus), Potassii Carbonas Purus, Sal Tartari; Fr. Carbonate de Potasse; Ger. Kalium carbonicum, Kaliumkarbonat, Kohlensaures Kali.)

Manufacture: This is obtained by percolating wood-ashes with water, which takes up the potassium carbonate together with a little chloride, sulphate, also the sodium salts, while calcium and magnesium carbonates, phosphates, and sulphates, together with silica, are left behind. This percolate (lye) is evaporated, giving *crude potash* (*Kalium carbonicum crudum, Pottasche*, Ger.), which by calcining becomes *pearl-ash*, and this in turn purified yields the official carbonate. It may also be derived from residual ash in beet-sugar manufacture, or washings of sheep-wool, or from the native chloride by Leblanc's process for sodium carbonate, and likewise from the purer bicarbonate by heat—$2KHCO_3 = K_2CO_3 + H_2O + CO_2$. It is a white granular powder, odorless, strongly alkaline taste, very deliquescent, soluble in water (.9), boiling water (.7), insoluble in alcohol, aqueous solution (1 in 20) strongly alkaline to litmus and phenolphthalein T. S., effervesces with acids; contains, when dried, 99 p. c. of pure salt, but may have 15 p. c. of water. *Tests:* 1. Heat to 180° C. (356° F.)—loses all water; at bright red heat —melts; at white heat—volatilizes, imparting violet flame with a possible transient yellow tinge. 2. Aqueous solution (1 in 10) with excess of tartaric acid T. S.—white crystalline precipitate of potassium bitartrate. *Impurities:* Heavy metals, insoluble substances, water. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.); externally in solution (2 p. c. + water), ointment (2–12 p. c. + lard).

Preparations.—1. *Pilulæ Ferri Carbonatis*, $1\frac{1}{4}$ gr. (.075 Gm.)—$FeCO_3$ 1 gr. (.06 Gm.). 2. *Syrupus Rhei*, 1 p. c. 3. *Syrupus Rhei*

Aromaticus, .1 p. c. 4. *Liquor Cocci, N.F.*, 3.2 p. c. 5. *Mistura Carminativa, N.F.*, $\frac{3}{10}$ p. c. 6. *Mistura Rhei Alkalina, N.F.*, 1.6 p. c. 7. *Sal Vichyanum Factitium, N.F.*, 3.85 p. c. 8. *Syrupus Asari Compositus, N.F.*, $\frac{1}{4}$ p. c. 9. *Tinctura Guaiaci Composita, N.F.*, $\frac{3}{5}$ p. c. 10. *Tinctura Rhei Aquosa, N.F.*, 1 p. c. 11. *Unguentum Sulphuris Alkalinum, N.F.*, 10 p. c.

Uses.—Chiefly in the preparation of the other potassium salts, also as an antacid in dyspepsia, diuretic in dropsy, antilithic in uric acid gravel, jaundice; externally in cutaneous affections, caustic, irritant poison.

Poisoning: Same as for potassium hydroxide. Give antidotes—fixed oils, vegetable acids, lemon juice, vinegar, demulcents.

Potassii Bicarbonas. Potassium Bicarbonate, $KHCO_3$. *U.S.P.*—(Syn., Pot. Bicarb., Acid Carbonate of Potassium, Kali Carbonicum Acidulum, Bicarbonas Potassicus (Kalicus); Fr. Bicarbonate de Potasse; Ger. Kalium bicarbonicum, Kaliumbikarbonat, Doppelt-Kohlensaures Kali.)

Manufacture: Pass carbon dioxide through strong solution of potassium carbonate, when the less soluble bicarbonate precipitates—$K_2CO_3 + H_2O + CO_2 = 2KHCO_3$. It is in colorless, transparent, monoclinic, odorless prisms, or white, granular powder, saline, slightly alkaline taste, permanent, soluble in water (2.8), hot water (2), almost insoluble in alcohol; contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 10) slightly alkaline to litmus, neutral or slightly alkaline to phenolphthalein T. S.; effervesces with acids; heated above 50° C. (122° F.) rapidly loses carbon dioxide and water, and at boiling temperature salt is converted into normal carbonate. 2. Heated to 100° C. (212° F.) salt loses carbon dioxide and water, and at red heat yields residue of carbonate, which gives violet flame; aqueous solution with excess of tartaric acid T. S.—white, crystalline precipitate of potassium bitartrate. *Impurities:* Heavy metals, carbonate, etc. Should be kept in well-closed containers. Dose, gr. 5–60 (.3–4 Gm.), well diluted.

Preparations.—1. *Liquor Potassii Arsenitis*, 2 p. c. (+ arsenic trioxide 1 p. c.). 2. *Liquor Potassii Citratis*, 8 p. c. of bicarbonate. 3. *Liquor Magnesii Citratis*, 38.5 gr. (2.5 Gm.) of bicarbonate to each bottle. 4. *Elixir Manacæ Compositum, N.F.*, 3.97 p. c. 5. *Liquor Aromaticus Alkalinus, N.F.*, 2 p. c.

Uses.—As the purest source of the potassium salts, similar to carbonate, but has milder taste and is more acceptable to the stomach. Used in irritability of bladder, acid urine, stomach hyperacidity, gouty and uric-acid diathesis, jaundice, increasing and rendering more fluid bronchial secretions, beverages, laxative draughts, etc.

Potassii Hydroxidum. Potassium Hydroxide, KOH, *U.S.P.*—(Syn., Pot. Hydrox., Caustic Potash, Potassium Hydrate, Potassa, Kali Hydricum Fusum (Purum), Oxydum Potassicum, Lapis Causticus

Chirurgorum; Br. Potassa Caustica; Fr. Potasse caustique (fondue), Pierre à Cautère; Ger. Kali causticum fusum, Kaliumhydroxyd, Ätzkali.)

Manufacture: Evaporate liquor potassii hydroxidi to dryness, then pour into molds and quickly bottle to prevent deliquescence. It may also be made by action of the metal potassium on water, and evaporating—$K + H_2O = KOH + H$. It is in dry, white or nearly white fused masses, sticks, hard, brittle, crystalline fracture, odorless (handle and taste very cautiously, as it rapidly destroys organic tissues), on exposure rapidly absorbs carbon dioxide and moisture (deliquesces), soluble in water (.9), boiling water (.6), alcohol (3), glycerin (2.5), boiling alcohol; aqueous solution strongly alkaline; contains 85 p. c. of pure base. *Tests:* 1. Aqueous solution (1 in 10) added to excess of tartaric acid T. S.—white, crystalline precipitate, redissolved by excess of potassium hydroxide. 2. Imparts violet flame. *Impurities:* Heavy metals, organic matter, insoluble substances. Should be kept in air-tight containers—bottles made of hard glass and cork stoppers paraffined. Dose, gr. 1–2 (.06–.13 Gm.), well diluted.

Preparations.—1. *Liquor Potassii Hydroxidi.* Solution of Potassium Hydroxide. (Syn., Liq. Pot. Hydrox., Liquor Potassæ, Solution of Potassa, Solution of Potassium Hydrate, Solution of Caustic Potash, Kali Hydricum Solutum, Lixivium Causticum; Fr. Potasse caustique liquide, Lessive caustique; Ger. Liquor Kali caustici, Kalilauge, Ätzkalilauge.)

Manufacture: 5 p. c. Mix dekanormal solution of potassium hydroxide 9 cc. (or 6 Gm. 85 p. c. KOH) with distilled water q. s. 100 cc. It is a clear, colorless, odorless liquid (solution), very acrid, caustic taste (even if largely diluted, when it only should be tasted), strongly alkaline, readily absorbs carbon dioxide from the air, sp. gr. 1.046; contains in each 100 cc. 4.5–5.5 Gm. of KOH. *Impurities:* Carbonate, etc. Should be kept in bottles made of hard glass, with rubber stoppers, or glass stoppers coated with petrolatum. Dose, ♏v–30 (.3–2 cc.), well diluted.

Preps.: 1. *Liquor Cresolis Compositus,* 2.2 p. c. 2. *Sapo Mollis,* 2.9 p. c. 3. *Elixir Catharticum Compositum, N.F.,* $\frac{9}{20}$ p. c. 4. *Mistura Copaibæ, N.F.,* 3 p. c. 5. *Syrupus Eriodictyi Aromaticus, N.F.,* 2.5 p. c.

Unoff. Prep.: Potassa with Lime, each 50 p. c.; used externally.

Properties.—Potassium hydroxide is one of our strongest caustics or escharotics; destroys tissues by abstracting moisture and dissolving albumin, fibrin, and gelatin. Its action differs from that of silver nitrate in not being superficial, but in penetrating deeply. Internally—before meals stimulates acid secretions, at the end or after meals neutralizes gastric juice already secreted; renders blood alkaline in which it circulates (possibly as carbonates); renders urine alkaline, increasing its power of holding uric acid in solution; promotes waste, bronchial secretions, checks saliva.

Uses.—To cauterize chancres, poisoned wounds, ingrown nails, scrofulous abscesses, carbuncles, tumors, varicose veins, diphtheria, urethral stricture, corns. Internally, as an antacid in acid dyspepsia, calculus disorders. Liquor—used similarly, but owing to less strength has a much milder action; potassa with lime—acts more strongly and is less deliquescent than the pure base.

Poisoning: Similar to ammonia. Have sensation of heat in throat, vomiting, diarrhea, abdominal pain, feeble, quick pulse, clammy skin, tongue, lips, and throat swollen, soft, red, convulsions, delirium, death. Give emetics, or wash out stomach, weak acids, lemon juice, vinegar, demulcents, oils, flaxseed tea, egg-white.

Incompatibles: Acids, acid salts, metallic salts, preparations of ammonia, belladonna, hyoscyamus, scopola, and stramonium (alkaloids being decomposed, and all alkaloids being precipitated by alkalies).

Potassa Sulphurata. Sulphurated Potassa, *U.S.P.*—(Syn., Pot. Sulphurat., Liver of Sulphur, Sulphuret of Potassium, Hepar Sulphuris; Fr. Sulfure de Potasse, Foie de Soufre; Ger. Kalium sulfuratum (Kali)-Schwefelleber.)

Manufacture: Mix sublimed sulphur 100 Gm. with dried potassium carbonate 200 Gm., heat until fused, pour on a cold marble slab—$3K_2CO_3 + S_8 = 2K_2S_3 + K_2S_2O_3 + 3CO_2$. This indefinite chemical compound, a mixture chiefly of potassium polysulphides, K_2S_2 +, and thiosulphate, $K_2S_2O_3$, is in the form of irregular pieces, liver-brown when fresh, changing to greenish-yellow and gray by absorbing moisture, oxygen, and carbon dioxide; strong odor of hydrogen sulphide, bitter, acrid, alkaline taste; soluble in water (slight residue), alcohol dissolves only the sulphides; contains not less than 12.8 p. c. of sulphur in combination as sulphide. *Tests:* 1. Aqueous solution (1 in 10) is light brown and strongly alkaline, and with excess of acetic acid—brisk evolution of hydrogen sulphide and precipitation of sulphur; filtrate + excess of sodium bitartrate T. S. —white, crystalline precipitate within 15 minutes. Dose, gr. 3–10 (.2–.6 Gm.); externally in lotion, bath, ointment.

Properties and Uses.—Irritant, increases pulse, cutaneous circulation and heat, also mucous secretions; large doses sedative, laxative; chronic rheumatism, gout, cutaneous affections, painter's colic, asthma, chronic nasal catarrh, infantile croup, paralysis, scabies, scrofula, chronic bronchitis, whooping-cough, ascarides by injection.

Potassii Acetas. Potassium Acetate, $KC_2H_3O_2$, *U.S.P.*—(Syn., Pot. Acet., Sal Diureticus, Terra Foliata Tartari, Acetas Potassicus (Kalicus); Fr. Acétate de Potasse; Ger. Kalium aceticum, Kaliumazetat, Essig-saures Kali.)

Manufacture: Almost neutralize acetic acid with potassium carbonate (or bicarbonate), evaporate the solution to dryness, and fuse —(1) $K_2CO_3 + 2HC_2H_3O_2 = 2KC_2H_3O_2 + H_2O + CO_2$. (2) $KHCO_3 + HC_2H_3O_2 = KC_2H_3O_2 + H_2O + CO_2$. It is a white powder or in

crystalline flakes, masses of satin-like luster, odorless, warming, saline taste, very deliquescent, soluble in water (.5), boiling water (.2), alcohol (2.9); contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) alkaline to litmus, no effect on phenolphthalein T. S. 2. Fuses with slight heat, at higher temperature decomposes with inflammable empyreumatic vapors, and black residue of potassium carbonate and carbon, which gives violet flame, is alkaline and effervesces with acids. 3. Aqueous solution (1 in 5) and sodium bitartrate T. S. each 5 cc. —white crystalline precipitate; heat .1 Gm. with sulphuric acid and alcohol each 1 cc.—ethyl acetate, recognized by odor. *Impurities:* Heavy metals, arsenic, etc. Should be kept in air-tight containers. Dose, gr. 10–60 (.6–4 Gm.); laxative, ʒij–4 (8–15 Gm.).

Preparations.—1. *Elixir Buchu et Potassii Acetatis, N.F.*, 8.5 p. c. 2. *Elixir Buchu, Juniperi et Potassii Acetatis, N.F.*, 5 p. c.

Properties.—Diuretic, diaphoretic, aperient, non-irritating, anti-scorbutic; renders urine alkaline, preventing and dissolving uric acid precipitates (gravel).

Uses.—Dropsies (not so good as the bitartrate), acute rheumatism, gout, liver derangements, jaundice, congestion of spleen, uterus, and hemorrhoidal vessels, skin diseases (eczema, psoriasis, lepra), febrile affections, to render urine alkaline. All organic acid salts are believed to be converted into carbonates in the stomach.

Potassii Citras. Potassium Citrate, $K_3C_6H_5O_7.H_2O$, *U.S.P.*—(Syn., Pot. Cit., Kalium Citricum, Citras Potassicus (Kalicus); Fr. Citrate de Potassium; Ger. Kaliumzitrat, Citronsaures Kali.)

Manufacture: Saturate to neutrality a solution of citric acid with potassium carbonate (or bicarbonate), filter, evaporate, granulate—(1) $3K_2CO_3 + 2H_3C_6H_5O_7,H_2O = 2K_3C_6H_5O_7,H_2O + 3H_2O + 3CO_2$. (2) $3KHCO_3 + H_3C_6H_5O_7,H_2O = K_3C_6H_5O_7,H_2O + 3H_2O + 3CO_2$. It occurs in transparent, prismatic crystals or white granular powder, odorless, cooling, saline taste, deliquescent, soluble in glycerin, water (.6), almost insoluble in alcohol; aqueous solution (1 in 20) alkaline to litmus, not reddened by 1 drop of phenolphthalein T. S.; contains, when dried, 99 p. c. of crystallized salt. *Tests:* 1. Heat to 200° C. (392° F.)—loses water of crystallization; at higher heat—decomposes, turns brown, carbonizes, emits inflammable gases of pungent, acrid odor; at red heat—residue of alkaline reaction, strongly effervescing with acids. 2. Aqueous solution (1 in 10) with sodium bitartrate T. S.—white, crystalline precipitate; aqueous solution (1 in 20) and calcium chloride T. S. each 10 cc.—liquid remains clear until boiled, then white, granular precipitate. *Impurities:* Heavy metals, arsenic, tartrate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.); mild laxative, ʒj–2 (4–8 Gm.).

Preparations.—1. *Potassii Citras Effervescens.* Effervescent Potassium Citrate. (Syn., Pot. Cit. Eff.; Fr. Citrate de Potasse Effervescent; Ger. Brausendes Kaliumcitrat.)

Manufacture: Dry potassium citrate 20 Gm. until it ceases to lose weight, powder and mix with powdered citric acid 16.2, tartaric acid 25.2, then with sodium bicarbonate 47.7, heat in oven 93–104° C. (199-219° F.); manipulate mixture carefully with wooden spatula until it becomes moist, rub through No. 6 tinned-iron sieve, dry granules at 54° C. (130° F.). Should be kept in well-sealed containers, to avoid contact with moist air. Dose, gr. 10–60 (.6–4 Gm.).

2. *Liquor Hypophosphitum Compositus, N.F.,* $\frac{85}{100}$ p. c. 3. *Syrupus Calcii Lactophosphatis et Ferri, N.F.,* $\frac{85}{100}$ p. c.

Liquor Potassii Citratis. Solution of Potassium Citrate, *U.S.P.*—Syn., Liq. Pot. Cit., Mistura Potassii Citratis, Neutral Mixture, Liquor Kali Citrici; Fr. Citrate de Potassium liquide; Ger. Kaliumzitratlösung.)

Manufacture: Dissolve potassium bicarbonate 8 Gm., citric acid 6, each, in distilled water 40 cc., filter solutions separately, wash each filter with distilled water q. s. 50 cc., mix solutions, when effervescence ceases transfer to bottle and stopper tightly. It is a clear, colorless, aqueous liquid (solution), odorless, mildly saline taste, slightly acid reaction; contains 8 p. c. of potassium citrate, with small amounts of citric and carbonic acids; must not be dispensed unless recently prepared. Dose, ʒss–2 (15–60 cc.).

Properties.—Refrigerant, diaphoretic, diuretic, antiscorbutic, arterial sedative, similar to the acetate.

Uses.—Febrile affections (this action is increased with spirit of ethyl nitrite or tincture of antimony), remittent, intermittent fevers with hot, dry skin. If given with lemon juice, beneficial in rheumatism, uric acid diathesis, acute bronchitis (first stages).

Potassii Bitartras. Potassium Bitartrate, $KHC_4H_4O_6$, *U.S.P.*—(Syn., Pot. Bitart., Cream of Tartar, Acid Potassium Tartrate, Supertartrate of Potassa, Crystals of Tartar, Kali Bitartaricum, Bitartras Potassicus (Kalicus), Cremor Tartari; Br. Potassii Tartras Acidus; Fr. Bitartrate de Potasse, Pierre de Vin; Ger. Tartarus depuratus, Weinstein.)

Manufacture: By purifying argol (crude tartar), which deposits in wine casks as a result of fermenting grape-juice. This argol is taken from the sides and bottom of the casks, boiled in water, clay added to precipitate coloring matter, filtered through animal charcoal, crystallized; to remove the 5–15 p. c. calcium tartrate present, dissolve in boiling water, add 8–10 p. c. hydrochloric acid, stir while cooling. It is in colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, odorless, pleasant, acidulous taste, permanent, soluble in water (155), boiling water (16), alcohol (8820); saturated aqueous solution acid; contains 99.5 p. c. of pure salt. *Tests:* 1. Heat on platinum foil—chars with inflammable vapors having odor of burning sugar; at higher temperature, with free access of air, carbon of black

residue is consumed leaving a white, fused mass of potassium carbonate, which is alkaline, effervesces with acids and colors flame violet. 2. Saturated aqueous solution with sodium cobaltic nitrite T. S.—yellow precipitate; neutralize saturated aqueous solution with sodium hydroxide T. S., add silver nitrate T. S. + ammonia water q. s. to dissolve white precipitate, boil—silver deposits as mirror on inner surface of test-tube. *Impurities:* Heavy metals, lead, alum, starch, kaolin, calcium phosphate, other insoluble matter. Should be kept in well-closed containers. Dose, aperient, gr. 10–60 (.6–4 Gm.); hydragogue cathartic, ʒss–4 (2–15 Gm.); diuretic, gr. 10–60 (.6–4 Gm.), ter die.

PREPARATIONS.—1. *Pulvis Jalapæ Compositus*, 65 p. c. 2. *Liquor Cocci, N.F.*, 6.5 p. c. 3. *Species Laxativæ, N.F.*, 10 p. c. 4. *Tabellæ Sulphuris et Potassii Bitartratis, N.F.*, each, 1 gr. (.06 Gm.).

Potassii et Sodii Tartras. Potassium and Sodium Tartrate, $KNaC_4H_4O_6.4H_2O$, *U.S.P.*—(Syn., Pot. et Sod. Tart., Rochelle Salt, Tartarated Soda, Natrokali Tartaricum, Soda Tartarata, Sal Polychrestum Seignetti, Tartras Potassico-sodicus; Fr. Sel de Seignette, Soude Tartarisée; Ger. Tartras natronatus, Kaliumnatriumtartrat, Seignettesalz.)

FIG. 447.—Rochelle salt crystal.

Manufacture: Add potassium bitartrate to hot solution of sodium carbonate, to neutralize free acid, thus obtaining normal double tartrate—$2KHC_4H_4O_6 + (Na_2CO_3 + 10H_2O) = 2(KNaC_4H_4O_6,-4H_2O) + CO_2 + 3H_2O$; practically 8 parts potassium bitartrate + 6 sodium carbonate crystals yield 12 crystallized Rochelle salt. It is in colorless, transparent, rhombic prisms, or white powder, odorless, cooling saline taste, crystals slightly efflorescent in dry air, soluble in water (.9), practically insoluble in alcohol; aqueous solution (1 in 20) alkaline to litmus, but 10 cc. not reddened by a drop of phenolphthalein T. S.; contains 73.72–77.39 p. c. of anhydrous potassium and sodium tartrate, corresponding to 99 p. c. of crystallized salts. *Tests:* 1. Heat to 74° C. (165° F.)—fuses to colorless liquid, which at higher heat froths, becomes brown, gradually carbonizes, emitting inflammable vapors of burning-sugar odor, residue consisting of potassium and sodium carbonates with carbon, imparting intensely yellow flame. 2. Aqueous solution (1 in 10) with acetic acid—white, crystalline precipitate; with silver nitrate T. S.—white precipitate, black on boiling; 5 cc., heated with sodium hydroxide T. S.—no ammonia evolved. *Impurities:* Heavy metals, lead, ammonia, etc. Should be kept in well-closed containers. Dose, aperient, ʒij–4 (8–15 Gm.); hydragogue cathartic, ʒj (30 Gm.).

PREPARATION.—1. *Pulvis Effervescens Compositus.* Compound Effervescing Powder. (Syn., Pulv. Eff. Co., Seidlitz Powder, Pulveres Effervescentes Aperientes; Br. Pulvis Sodæ Tartaratæ Effervescens,

Effervescent Tartarated Soda Powder; Fr. Poudre gazifère purgative, Poudre de Seidlitz; Ger. Pulvis aërophorus, Brausepulver, Pulvis Laxans or Seidlitzensis, Brausepulver Abführendes, Seidlitzpulver.

Manufacture: Mix thoroughly sodium bicarbonate gr. $38\frac{3}{4}$ (2.5 Gm.) with potassium and sodium tartrate gr. 115.5 (7.5 Gm.), wrap in blue paper; then wrap in white paper tartaric acid gr. 33.5 (2.2 Gm.); contains (blue paper) 9.5 10.5 Gm.; 23–27 p. c. of sodium bicarbonate, 73–78 p. c. of potassium and sodium tartrate; (white paper) 2–2.4 Gm, tartaric acid. *Tests:* 1. Aqueous solution of blue paper contents (1 in 20) and acetic acid, each 5 cc., after effervescence shake vigorously—white, crystalline precipitate, soluble in ammonia T.S. Should be kept dry, in well-closed containers. Dose, 1 powder; dissolve contents of the blue paper in a half-glass of water (ordinary temperature), and to this add contents of the white paper—drink while effervescing.

Properties.—Cream of tartar, Rochelle salt, and Seidlitz powders are all diuretic, purgative, refrigerant, antilithic.

Uses.—Febrile diseases, dropsy, hemorrhoids, vomiting from gastric acidity and pregnancy. Cream of tartar is believed to be eliminated from the system unchanged, hence not so good when alkalinity desired for blood and urine. Small and frequent doses of Rochelle salt simply make urine alkaline.

Potassii Chloras. Potassium Chlorate, $KClO_3$, *U.S.P.*—(Syn., Pot. Chloras, Kali Oxymuriaticum, Kali Muriaticum Oxygenatum, Chloras (Potassicus) Kalicus, Hyperoxymuriate of Potassa; Fr. Chlorate de Potasse; Ger. Kalium chloricum, Kaliumchlorat, Chlorsaures Kali.)

Manufacture: Pass chlorine into water holding lime (preferably magnesium oxide) in suspension, thereby forming chloride and hypochlorite, the latter by heat being converted into chlorate and chloride, treat solution with potassium chloride, giving potassium chlorate which crystallizes out, and potassium (magnesium) chloride that remains in solution; magnesium is preferred, as potassium chlorate is less soluble in solution of magnesium chloride than of calcium chloride —$2Ca(OH)_2+Cl_4=Ca(ClO)_2+CaCl_2+2H_2O$; $3Ca(ClO)_2 = Ca(ClO_3)_2 + 2CaCl_2$; $Ca(ClO_3)_2 + 2KCl = 2KClO_3 + CaCl_2$. May also be made by passing electric current into solution potassium chloride. It is in colorless, lustrous, monoclinic prisms, plates, or white granular powder, odorless, saline taste, permanent, soluble in glycerin, water (16.5), boiling water (1.8), almost insoluble in alcohol; aqueous solution (1 in 20) neutral; contains 99 p. c. of pure salt. *Tests:* 1. When heated to 360° C. (680° F.)—melts giving off oxygen, leaving residue of potassium chloride, readily soluble in water, and yielding with silver nitrate

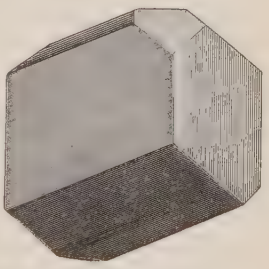


Fig. 448.—Potassium chlorate crystal.

T. S. a white precipitate, insoluble in nitric acid, soluble in ammonia water; imparts violet flame; add .2 Gm. to hydrochloric acid 1 cc.—deep greenish-yellow color, chlorine and oxides of chlorine evolved. 2. Aqueous solution (1 in 20) with excess of tartaric acid T. S.—scant, white, crystalline precipitate (slowly); with platinic chloride T. S.—yellow crystalline precipitate. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers, and handled cautiously, as dangerous explosions may occur if heated, subjected to concussion or triturated with organic substances (cork, tannin, dust, sugar, sulphur, antimony sulphide (sulphides), phosphorus, hypophosphites, catechu, glycerin, etc. Dose, gr. 5–20 (.3–1.3 Gm.).

PREPARATIONS.—1. *Gargarisma Guaiaci Compositum, N.F.*, 4 p. c. 2. *Liquor Chlori Compositus,* Chlorine Water, *N.F.*, pot. chloras .7 Gm. (10.5 gr.), acid. hydrochl. 2 cc. (ʒss), aq. dest. q. s. 100 cc. Dose, ʒss–1 (2–4 cc.).

Unoff. Prep.: Troches, pot. chloras, $2\frac{1}{3}$ gr. (.145 Gm.), each.

PROPERTIES.—Alterative, stimulant, oxidizant, irritant, diuretic, poisonous; converts hemoglobin into methemoglobin, disintegrates red corpuscles.

USES.—Mercurial salivation and ulcers of the mouth, ulcerated stomatitis, aphthæ, buccal and pharyngeal diphtheria, hemorrhoids, thrush, croup, ozena, fetid breath, dysentery, vaginitis, cystitis. Internally in scrofula, scarlatina, typhoid fever, cardiac cyanosis, dropsy, blood poisoning, malignant fevers. Mostly excreted by the kidneys unchanged.

Poisoning: Excessive quantities (ʒij–4; 8–15 Gm.) produce vomiting, diarrhea, dyspnea, heart-failure, cyanosis, nervous disturbance, jaundiced skin, delirium, coma, acute nephritis, death. Induce vomiting and give abundant water, mucilaginous drinks to dilute, opium for pain, amyl nitrite, keep loins warm, avoid renal stimulants.

Potassii Bromidum. Potassium Bromide, KBr, *U.S.P.*—(Syn., Pot. Brom., Bromuretum (Potassicum) Kalicum; Fr. Bromure de Potassium; Ger. Kalium bromatum, Kaliumbromid, Bromkalium.)

Manufacture: Add bromine to solution potassium hydroxide until liquid remains colored, thereby producing bromide and bromate, evaporate to dryness, mix with charcoal, heat to redness, thus converting all of the bromate into bromide—(1) $6KOH + 6Br = 5KBr + KBrO_3 + 3H_2O$. (2) $2KBrO_3 + 6C = 2KBr + 6CO$. The KBr is dissolved out of the mass with water, and solution allowed to crystallize. The salt may also be made by decomposing ferrous bromide with potassium carbonate—$K_2CO_3 + FeBr_2 = 2KBr + FeCO_3$. The iron carbonate is precipitated, while potassium bromide remains in solution. It is in colorless or white cubical crystals or granular powder, odorless, strongly saline taste, permanent, soluble in water, (1.5), boiling water (1), alcohol (250), boiling alcohol (21), glycerin (4.6); aqueous solution (1 in 20) neutral or faintly alkaline; contains 98.5 p. c. of pure salt.

Tests: 1. Heat upon platinum foil—decrepitates; at higher temperature, 750° C. (1382° F.), fuses without decomposition, at bright red volatilizes with violet flame. 2. Aqueous solution (1 in 5) and sodium bitartrate T. S. each 5 cc.—white, crystalline precipitate; with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or ammonia water. *Impurities:* Heavy metals, barium, alkalies, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.), ter die, in water, elixir, syrup. In strychnine poisoning give ʒiij–4 (12–15 Gm.) at once; in tetanus the same amount within 24 hours.

Preparations.—1. *Elixir Potassii Bromidi, N.F.*, 17.5 p. c., + syrup 20, aq. dest. 46, elix. arom. q. s. 100. Dose, ʒj–2 (4–8 cc.). 2. *Sal Potassii Bromidi Effervescens Compositum, N.F.*, 8.3 p. c., + lith. carb. 4.2, caffeine $\frac{4}{5}$, +. 3. *Elixir Bromidorum Quinque, N.F.*, 7 p. c., + sod. brom. 8.75, calc. brom. $5\frac{1}{4}$, lith. brom. 3.5, ammon brom. $1\frac{3}{4}$, +. 4. *Elixir Bromidorum Trium, N.F.*, 8 p. c., + ammon. brom. 8, sod. brom. 8, +. Dose, each, ʒss–1 (2–4 cc.). 5. *Mistura Chloralis et Potassii Bromidi Composita, N.F.*, 20 p. c. 6. *Syrupus Bromidorum, N.F.*, 8 p. c., + sod. brom. 8, ammon. brom. 5, calc. brom. $2\frac{1}{2}$, lith. brom. $\frac{4}{5}$, +. Dose, ʒss–1 (2–4 cc.).

Properties.—Sedative, hypnotic, anesthetic, narcotic, antiseptic, anaphrodisiac. All bromides in the stomach and intestines are converted quickly into sodium bromide, and as such are absorbed. Large doses lessen force and frequency of heart-beat, causing a stoppage in diastole. Eliminated by kidneys, skin, intestinal and bronchial mucous membranes, in saliva, milk.

Uses.—Epilepsy (standard palliative), hysterical, infantile, and puerperal convulsions, neuralgia, insanity, delirium tremens, chorea, tetanus, sunstroke, hysteria, whooping-cough, spasmodic asthma, persistent vomiting (sovereign remedy—rectum), vomiting of phthisis, sea-sickness, nervousness, angina pectoris, diabetes, seminal emissions, priapism, incontinence of urine, in teething, toothache, headache (+ caffeine, acetanilid), urticaria, acne, intermittent fever, enlarged spleen, amblyopia, diphtheria, to anesthetize the pharynx, larynx, urethra, irritable bladder, enlarged prostate, gangrenous sores, strychnine poisoning. After prolonged use may have *bromism*, which consists of muscular weakness, mental and bodily sluggishness, loss of memory, stupidness, depressed spirits, constipation, impaired digestion, apathy, low temperature, with patient recumbent in bed, prostrated and almost lifeless; fetid breath, coated tongue, and acneiform eruption are its first constitutional symptoms, which may largely be aborted by Fowler's solution ♏j–5 (.06–.3 cc.) with each dose of bromide.

Poisoning: Withdraw drug, give diuretics, cathartics, tonics, iron, strychnine, cardiac stimulants, strong coffee, caffeine citrate, digitalis, morphine (best antagonist to mental symptoms), ergot, atropine.

Incompatibles: Motor excitants, cardiac stimulants, acids, acidulous and metallic salts.

Synergists: Opium, hypnotics, cardiac depressants.

Potassii Iodidum. Potassium Iodide, KI, *U.S.P.*—(Syn., Pot. Iod., Kali Hydriodicum, Ioduretum (Potassicum) Kalicum; Fr. Iodure de Potassium; Ger. Kalium jodatum, Kaliumjodid, Jodkalium.)

Manufacture: Add iodine to hot solution potassium hydroxide until dark brown color is permanent, thus producing iodide and iodate; this solution is evaporated to dryness, mixed with charcoal, and heated to redness, in order to convert all iodate into the iodide—(1) $6KOH + 6I = 5KI + KIO_3 + 3H_2O$. (2) $2KIO_3 + 6C = 2KI + 6CO$. The KI is dissolved out of the mass with boiling water, and solution set aside to crystallize; may also be prepared by action of ferrous iodide and potassium carbonate, or from the mother-liquors of Chile saltpetre. It is in colorless, transparent, or opaque, white, cubical crystals, or white, granular powder, pungent, saline, bitter taste, permanent, slightly deliquescent, soluble in water (.7), boiling water (.5), alcohol (22), boiling alcohol (8), glycerin (2); aqueous solution (1 in 20) neutral, slightly alkaline; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. When heated—decrepitates; at low red heat 684° C. (1463° F.)— fuses; at bright red heat—volatilizes without decomposition. 2. Aqueous solution (1 in 20) and sodium bitartrate T. S. each 5 cc.—white, crystalline precipitate; with 1 cc. of ferric chloride T. S. + distilled water 1 cc., shake with chloroform 5 cc.—latter violet color. *Impurities:* Heavy metals, barium, alkalies, cyanide, iodate, thiosulphate. Should be kept in well-closed containers. Dose, gr. 2–30 (.13–2 Gm.), ter die, largely diluted; in syphilis may give ʒij–4 (8–15 Gm.) daily, well diluted with water, milk, compound syrup of sarsaparilla.

Preparations.—1. *Acidum Hydriodicum Dilutum.* Diluted Hydriodic Acid, HI. (Syn., Acid. Hydriod. Dil.; Fr. Acide hydriodique dilué; Ger. Verdünnte Jodwasserstoffsäure.) An aqueous solution containing 9.5–10.5 p. c. of HI.

Manufacture: Dissolve potassium iodide 13.5 Gm. in distilled water 25 cc., and tartaric acid 12.2 Gm. in diluted alcohol 40 cc., pour latter into bottle 100 cc. capacity, and add hypophosphorous acid 2 cc., shake briskly, let cool several hours; fit tightly a pledget of purified cotton into a funnel, and to this transfer liquid; when filtered wash bottle and crystalline precipitate with several portion of diluted alcohol until filtrate weighs 100 Gm., warm liquid on water-bath until all alcohol has evaporated, add distilled water q. s. 100 Gm. It is a colorless, pale yellow, odorless liquid, strongly acid taste and reaction; sp. gr. 1.100. *Tests:* 1. Evaporate on water-bath 5 cc. to dryness, ignite to dull red heat, 750° C. (1382° F.)—residue .165 Gm. 2. Add distilled water (2), + few drops of ferric chloride T. S. or chlorine water—liberates iodine, reddish-brown solution. 3. Agitate preceding mixture with chloroform (few drops)—latter becomes violet. *Impurities:* Heavy metals, arsenic, barium, free iodine, chloride, sulphate. Should be kept dark, in amber-colored, glass-stoppered bottles, and not dispensed if containing free iodine. Absolute hydriodic acid is a

colorless, irrespirable, non-inflammable gas, sp. gr. 4.440, having odor of hydrochloric acid, strongest solution obtainable being 57.75 p. c. Dose, ♏v–30 (.3–2 cc.).

Prep.: 1. *Syrupus Acidi Hydriodici.* Syrup of Hydriodic Acid. (Syn., Syr. Acid. Hydriod.; Fr. Sirop d'Acide iodhydrique; Ger. Jodwasserstoffsirop.)

Manufacture: 1.4 p. c. Mix diluted hydriodic acid 13 cc. with 55 cc. distilled water in which dissolve sucrose 45 Gm. by agitation, add distilled water q. s. 100 cc., filter; 100 cc. contains 1.3–1.5 Gm. of pure acid. It is a transparent, colorless, pale straw-colored, syrupy liquid, odorless, sweet, acidulous taste, sp. gr. 1.185. *Impurities:* Free iodine, etc. Dose, ʒj–2 (4–8 cc.).

2. *Liquor Iodi Compositus,* 10 p. c. 3. *Tinctura Iodi,* 5 p. c. 4. *Unguentum Iodi,* 4 p. c. 5. *Liquor Potassii Iodidi, N.F.,* 100 p. c., + sod. thiosulph. $\frac{1}{20}$ p. c., aq. dest. q. s. 100. 6. *Unguentum Potassii Iodidi, N.F.,* 10 p. c., + sod. thiosulph. 1, water 9, adeps. benz. q. s. 100. 7. *Ampullæ Iodi, N.F.,* 2.5 p. c. 8. *Elixir Corydalis Compositum, N.F.,* 5 p. c. 9. *Elixir Sodii Salicylatis Compositum, N.F.,* 1.5 p. c. 10. *Liquor Iodi et Zinci Phenolsulphonatis, N.F.,* 15 p. c. 11. *Tinctura Iodidorum, N.F.,* 2.5 p. c. 12. *Tinctura Iodi Fortior, N.F.,* 3.5 p. c.

Unoff. Prep.: Linimentum Potassii Iodidi cum Sapone (Br.), 10 p. c.

PROPERTIES.—Alterative, stimulant, absorbent, irritant.

USES.—Specific in rheumatism, nervous diseases, secondary and tertiary syphilis, mercurial tremors and sore mouth, lead poisoning and palsy, aneurism of the aorta, dropsy, granular meningitis, chronic hydrocephalus, brain tumors, priapism, muscular rheumatism, sciatica, angina pectoris, heart diseases, gout, pneumonia, chronic bronchitis, asthma, paralysis, cord sclerosis. Hydriodic Acid and Syrup—similar to iodine and iodides, but less offensive to stomach and taste; chiefly as alterative in scrofula, chronic bronchitis, malarial poisoning, etc. All preparations and compounds containing iodine, potassium iodide, etc., when given in large repeated doses produce constitutional symptoms known as *iodism,* preceded by coryza and pain over the brow, sore throat, fetid breath, swollen gums, eruptive acne, neuralgia, emaciation, cardiac palpitation.

Poisoning, Incompatibles: Same as for iodine, see page 705.

Potassii Nitras. Potassium Nitrate, KNO_3, *U.S.P.*—(Syn., Pot. Nitras, Saltpetre, Nitre, Nitras (Potassicus) Kalicus, Sal (Petræ) Nitri, Nitrum Depuratum; Fr. Azotate (Nitrate) de Potasse, Nitre prismatique; Ger. Kalium nitricum, Kaliumnitrat, Kalisalpeter, Salpetersaures Kali.)

Manufacture: While this may be made by neutralizing nitric acid with potassium carbonate, yet by far the greater part of that used is found as a natural salt in Chile, Peru, India, etc. Some of this supply, however, is a product of nitre beds, which consist of a mechanical mixture of animal refuse, earth, and lime, protected under cover. By

putrefaction ammonia is formed, which, upon oxidation, becomes nitric acid and unites with the calcium; this is dissolved out and decomposed with potassium carbonate or chloride—$Ca(NO_3)_2 + K_2CO_3 = 2KNO_3 + CaCO_3$. Saltpetre may also be obtained from Chile saltpetre by double decomposition—$NaNO_3 + KCl = KNO_3 + NaCl$. It is colorless, transparent, 6-sided, rhombic prisms, or white crystalline powder, odorless, saline taste, with cooling sensation in the mouth, slightly hygroscopic, soluble in glycerin, water (2.8), boiling water (.5), alcohol (620); aqueous solution (1 in 10) neutral; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. Heat strongly—melts without decomposition; at higher heat—evolves oxygen, partly reduced to nitrite; heated with charcoal—deflagrates. 2. Aqueous solution (1 in 20) with sodium bitartrate T. S.—white crystalline precipitate; aqueous solution (1 in 10) with 1 drop of diphenylamine T. S. + sulphuric acid slowly added to form separate layer—deep blue at line of contact. *Impurities:* Heavy metals, chlorate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

Fig. 449. — Potassium nitrate crystal.

Preparation.—1. *Charta Potassii Nitratis, N.F.,* dissolve potassium nitrate 20 Gm. in water 80 cc.; immerse in solution strips of white, unsized paper, dry, keep in well-closed containers.

Properties. — Refrigerant, diuretic, diaphoretic, antiseptic, purgative, nervous sedative, cardiac depressant (causing fewer and feebler beats), irritant, alterative; enters blood unchanged; eliminated by kidneys unchanged.

Uses.—Acute rheumatism, pneumonia, fevers (acetate and citrate preferable), dropsy, stomatitis, bronchitis, freckles, bruises, abrasions, scurvy, angina, asthma, gout, gonorrhea, incontinence of urine, manufacture of gunpowder, preservation of meat. The *Charta, N.F.,* mostly burnt for asthma.

Poisoning: Severe gastro-enteritis, vomiting and purging of blood, suppressed urine, circulatory and respiratory depression, convulsions, death (rare). Give emetic (or use pump), mucilage, stimulants, opium (pain).

Potassii Permanganas. Potassium Permanganate, $KMnO_4$, *U.S.P.*—(Syn., Pot. Permang., Hypermanganas (Potassicus) Kalicus; Fr. Permanganate de Potasse; Ger. Kalium permanganicum, Kaliumpermanganat, Übermangansaures Kali.)

Manufacture: Fuse manganese dioxide with potassium carbonate (or hydroxide) and potassium chlorate (or nitrate). The manganese is converted into manganic acid, which, combining with the alkali, forms potassium manganate; this can be dissolved out by water, giving a dark emerald-green solution, and crystallized. If this solution now be acidified (H_2SO_4) or boiled with much water, it becomes red and

contains in solution $KMnO_4$ and a precipitate of MnO_2— (1) $3MnO_2 + 3K_2CO_3 + KClO_3 = 3K_2MnO_4 + KCl + 3CO_2$. (2) $3K_2MnO_4 + 2H_2SO_4 = 2KMnO_4 + 2K_2SO_4 + MnO_2.2H_2O$, or $3K_2MnO_4 + 2H_2O = 2KMnO_4 + MnO_2 + 4KOH$. It is in slender, monoclinic prisms, dark purple color, almost opaque by transmitted light, blue metallic luster by reflected light, odorless, sweet, disagreeable, astringent taste (in solution), permanent, soluble in water (13.5), boiling water (3.5), decomposed by alcohol; when heated decrepitates; at 240° C. (464° F.) decomposes, yielding oxygen, potassium manganate, and manganese dioxide; contains, when dried, 99 p. c. of pure salt. *Tests:* 1. Aqueous solution, rose to deep violet-red, has color discharged by hydrogen sulphide, ferrous sulphate, oxalic acid, alcohol, etc., especially if acidified by sulphuric acid. Should be kept in glass-stoppered bottles, and when dry or in solution must not be brought in contact with organic or other readily oxidizable substances, owing to liability of dangerous explosions. Dose, gr. 2–5 (.13–.3 Gm.), given on a full stomach in much water, or pill made with kaolin, soft paraffin, or wool fat.

Fig. 450. — Potassium permanganate crystal.

Preparation.—(Unoff.): *Liquor Potassii Permanganatis* (Br.), 1 p. c. Dose, ʒij–4 (8–15 cc.).

Properties.—Disinfectant, deodorant, antiseptic, caustic, stimulant, emmenagogue; liberates much of its oxygen as ozone.

Uses.—Externally—fetid and gangrenous ulcers, wounds, abscesses, carbuncles, gonorrhea, leucorrhea, otorrhea, diphtheria, cancerous ulcers, eczema. Internally—diphtheria, scarlatina, atonic amenorrhea, antidote to morphine, opium (by mouth; of little value by rectum, and still less hypodermically), dyspepsia, flatulence, poisoning by phosphorus, serpent bites, rabies; volumetric analysis (oxidimetry). The stains can be resolved by weak acid solutions (oxalic, hydrochloric), lemon juice, etc. It oxidizes to the extent of its available oxygen, forming harmless compounds; rubbed in a mortar with organic substance—explodes.

Allied Salts:

1. *Potassii Hypophosphis. Potassium Hypophosphite*, KPH_2O_2, *N.F.*, —Obtained by mixing solutions of potassium carbonate and calcium hypophosphite, getting double decomposition—$Ca(H_2PO_2)_2 + K_2CO_3 = 2KH_2PO_2 + CaCO_3$, filter from the calcium carbonate, evaporate, granulate. It occurs in white, opaque, hexagonal plates, crystalline masses, or granular powder, odorless, pungent, saline taste, very deliquescent, soluble in water (.6), boiling water (.4), alcohol (9), boiling alcohol (5); aqueous solution (1 in 20) neutral, slightly alkaline; with sodium bitartrate T. S.—white, crystalline precipitate; contains, when dried, 98 p. c. of pure salt. Heat in dry test-tube—spontaneously

inflammable hydrogen phosphide which burns with bright yellow flame; add aqueous solution (1 in 20), acidulated with hydrochloric acid, drop by drop with agitation, to excess of mercuric chloride T. S.—white precipitate of mercurous chloride; now add solution of potassium hypophosphite—precipitate becomes gray from reduction to metallic mercury. *Impurities:* Arsenic, phosphates. Considered valuable formerly owing to the phosphorus; phthisis, depleted nerve power, scrofulous affections, chronic bronchitis, coughs (expectorant). Should be kept dry, in well-closed containers, and dispensed with caution, as explosion may occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.); 1. *Emulsum Olei Morrhuæ cum Hypophosphitibus, N.F.*, $\frac{1}{2}$ p. c. 2. *Liquor Hypophosphitum Compositus, N.F.*, $\frac{85}{100}$ p. c. 3. *Syrupus Hypophosphitum, N.F.*, 1.5 p. c. 4. *Syrupus Hypophosphitum Compositus, N.F.*, $1\frac{3}{4}$ p. c.

2. *Potassii Sulphas. Potassium Sulphate*, K_2SO_4, *N.F.*—Obtained by decomposing potassium carbonate, nitrate, or chloride with sulphuric acid, or by neutralizing sulphuric acid with potassium hydroxide, or from kainite, but its greatest source is as a by-product in the manufacture of nitric acid — (1) $K_2CO_3 + H_2SO_4 = K_2SO_4 + H_2O + CO_2$ (2) $2KCl + H_2SO_4 = 2HCl + K_2SO_4$. (3) $2KNO_3 + H_2SO_4 = K_2SO_4 + 2HNO_3$. (4) $KNO_3 + H_2SO_4 = KHSO_4 + HNO_3$. In this ast formula the acid sulphate has to be converted into normal sulphate— $2KHSO_4 + K_2CO_3 = 2K_2SO_4 + CO_2 + H_2O$. It is in hard, colorless, translucent, 6-sided, rhombic prisms, terminated by pyramids, or in a white powder, odorless, bitter, saline taste, permanent; soluble in water (10), insoluble in alcohol. Heated—crystals decrepitate, bright red heat—fuses, white heat—partial decomposition; aqueous solution (1 in 20) neutral, when saturated, + excess of sodium bitartrate T. S.—white crystalline precipitate; contains 99 p. c. of pure salt. *Impurities:* Heavy metals, arsenic, calcium, magnesium. Mild purgative, cholagogue, operating usually without pain, heat, or perceptible irritation; given after labor and for drying up mammary secretion, dyspepsia, biliousness, albuminuria. Owing to hardness, it is used for pulverizing tough vegetable substances, like ipecac, etc. Usually prescribed with rhubarb, etc. Dose, ʒss–4 (2–15 Gm.); 1. *Salia Effervescentia* (2).

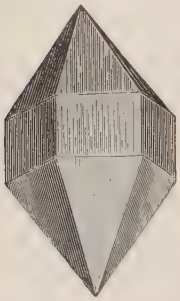


Fig. 451.—Potassium sulphate crystal.

3. *Potassii Chloridum. Potassium Chloride*, KCl, *N.F.*—Obtained at Stassfurt from *carnallite*, double chloride of potassium and magnesium. Occurs in colorless, elongated prismatic, or cubical crystals, or white granular powder, permanent in dry air; soluble in water (2.8), slightly more so in boiling water, insoluble in alcohol; aqueous solution (1 in 10) neutral; heated—dry salt decrepitates; imparts violet flame; with silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, but soluble in ammonia water; contains 99 p. c. of pure salt.

Impurities: Heavy metals, arsenic, calcium, magnesium, iodide, bromide. Used in making potassium salts, in Salia Effervescentia, whose composition accurately represent natural mineral waters, reagent. Dose, gr. 15–20 (1–1.3 Gm.); 1. *Liquor Hydrastinæ Compositus*, $\frac{1}{10}$ p. c. 2. *Salia Effervescentia* (1), 3.2 p. c.

4. *Potassii Cyanidum. Potassium Cyanide*, KCN, U.S.P. 1840–1900.—Obtained by passing hydrocyanic acid gas (potassium ferrocyanide (2) + sulphuric acid q. s.) into solution of potassium hydroxide in alcohol (1 in 5–6), washing precipitate with alcohol, or heat together potassium carbonate and potassium ferrocyanide—$K_2CO_3 + K_4Fe(CN)_6 = 5KCN + KCNO + Fe + CO_2$. May remove cyanate with alcohol or carbon disulphide, and, as the iron is precipitated to the bottom of iron retort, must, in pouring out the mass, stop short of any iron contamination. It is in white, opaque, amorphous pieces, white granular powder, without odor (dry), or odor of hydrocyanic acid (moist), sharp alkaline taste, deliquescent, soluble in water (2), sparingly in alcohol; contains 95 p. c. of pure salt. *Impurities:* Carbonate (HCl), ferrocyanide (Fe_2Cl_6, blue), sulphocyanates (Fe_2Cl_6, red); should be kept in well-stoppered bottles labelled poison, and handled with great care. Sedative, antispasmodic, anodyne—similar to hydrocyanic acid as poison and medicine; headache from dyspepsia, menstruation, etc. Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.), in water.

5. *Acidum Hydrocyanicum Dilutum. Diluted Hydrocyanic Acid*, HCN, U.S.P. 1820–1910.—Obtained (extemporaneously) by mixing diluted hydrochloric acid 15.54 cc. with distilled water 44.10 cc., adding silver cyanide 6 Gm., shaking, rejecting precipitate—$AgCN + HCl = HCN + AgCl$; or (commercially) by heating potassium ferrocyanide 20 Gm. with sulphuric acid 8 cc. + water 65 cc., passing evolved gas into distilled water 65 cc. It is a colorless liquid; characteristic odor (resembling bitter almond); acid reaction, volatile, very unstable and poisonous; use care in handling and tasting. Render 1 cc. alkaline with potassium hydroxide T. S., + few drops of ferrous sulphate T. S., boil, acidulate with hydrochloric acid—blue precipitate; evaporate 10 cc. —residue .002 Gm.; contains 1.9–2.1 p. c. HCN and not more than .1 p. c. HCl. *Impurities:* Hydrogen chloride, etc. Anesthetic, sedative, anodyne, antispasmodic; paralyzes sensory nerve-endings; small doses slows heart by stimulating vagus centers, larger doses may cause instant death (diastolic arrest)—paralyzing heart directly and cardiac center in medulla; causes all blood to be bright red; phthisis, dyspepsia, cough, asthma, nervous cough, angina pectoris. *Poisoning:* Symptoms established within a half to two minutes—giddiness, stupor, complete insensibility, eyes fixed, glistening, pupils dilated, dyspnea, limbs flaccid, skin cold, clammy, respiration slow, deep, convulsive, pulse weak, slow, almost imperceptible, convulsions, paralyzed spine, death from asphyxia (from paralysis of respiratory center), breath has bitter almond odor. If possible, wash out stomach, emetics, atropine hypodermically, gr. $\frac{1}{50}$ (.0013 Gm.), ether, brandy, ammonia inhalations,

chlorine water, artificial respirations and heat, cold water alternately on chest and spine, electricity; ferrous and ferric sulphates, followed by K_2CO_3 solution = insoluble Prussian blue (antidote). Rapidly eliminated by lungs and kidneys. Should be kept in small, dark amber-colored, well-filled vials. Dose, ♏j–3 (.06–.2 cc.), in water or alcohol. An acid of 5 p. c., less stable and reliable, is also manufactured.

6. *Potassii Ferrocyanidum. Potassium Ferrocyanide,* $K_4Fe(CN)_6.3H_2O$, U.S.P. 1840–1900.—Obtained by heating together potassium carbonate (pearl-ash), nitrogenous animal refuse (dried blood, hoofs, etc.), and iron scraps; the fused mass (melt) is lixiviated and this solution evaporated for crystallization—(1) $6KCN + Fe + 2H_2O = K_4Fe(CN)_6 + 2KOH + H_2$, or (2) $6KCN + FeS = K_4Fe(CN)_6 + K_2S$. Now very largely obtained from the mass of ferric hydroxide used to purify illuminating gas, as that absorbs cyanogen compounds forming ferrocyanides, etc. It is in large, soft, transparent, yellow, 4-sided, monoclinic tabular crystals or prisms, odorless, mild saline taste, soluble in water (4), insoluble in alcohol, efflorescent; contains 99 p. c. of pure salt. *Impurities:* Carbonate, ferricyanide. Not used much medicinally, although it is non-poisonous when pure; sometimes valuable in checking colliquative sweats of phthisis; important test reagent for copper, zinc, and ferric salts; chief source of cyanogen compounds.

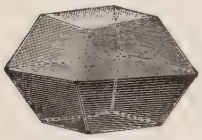


Fig. 452. — Potassium ferrocyanide crystal.

7. *Potassii Carbonas Impura. Impure Potassium Carbonate,* U.S.P. 1820–1870 (pearl-ashes, pearl-ash).—This is simply the crude potash salts, black salts, derived from the evaporated lye of wood-ashes, subjected to direct flame in an oven-shaped furnace. By this means all combustible impurities are burnt out, and the mass, from being black, becomes of a bluish-white color. It is still official in Germany as Kalium carbonicum crudum, Pottasche.

8. *Potassii Dichromas. Potassium Dichromate,* $K_2Cr_2O_7$, U.S.P. 1860–1900.—Obtained by heating together potassium carbonate, lime, and powdered chrome iron ore which has previously been roasted; the iron is oxidized into ferric oxide, and chromium into chromic acid; this latter attacks the potassium carbonate forming the neutral chromate, which is treated with an acid (H_2SO_4 or HNO_3) to get the acid or bichromate—(1) $2FeOCr_2O_3 + 4K_2CO_3 + O_7 = Fe_2O_3 + 4CO_2 + 4K_2CrO_4$. (2) $2K_2CrO_4 + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O$. It occurs in large, orange-red, transparent, triclinic prisms, or 4-sided tabular crystals, odorless, acidulous metallic taste, soluble in water (9), insoluble in alcohol, permanent; contains 99 p. c. of pure salt. At white heat evolves oxygen, leaving neutral potassium chromate and green chromic oxide; + sodium cobaltic nitrite T. S.—yellow precipitate. Irritant, caustic, alterative, expectorant; secondary syphilis; externally—caustic in tubercular enlargements, excrescences, warts, syphilitic sores, sloughing wounds; largely in calico-printing, pigments,

etc.; employees in its manufacture often suffer from ulcers on hands, face, nares, etc., from the irritating fumes. *Poisoning:* Have a violent irritative, corrosive condition; vomiting, hemorrhagic dejections, abdominal pains, dilated pupils, great depression, collapse, poor circulation, coma, heart failure, death. Give emetic, alkaline carbonate (bicarbonate), or magnesium oxide, chalk, demulcent drinks, milk, egg-white, stimulants, heat, opium. Should be kept in well-stoppered containers. Dose, gr. $\frac{1}{5}$ (.0013 Gm.), in pill.

Fig. 453.—Potassium dichromate crystal.

9. *Potassii Sulphis. Potassium Sulphite,* $K_2SO_3.2H_2O$, U.S.P. 1870–1880. — Obtained by passing SO_2 through solution of K_2CO_3 until the CO_2 is expelled, then adding equal weight of K_2CO_3, after which sulphite crystallizes out. It is in opaque octahedral crystals or crystalline powder, odorless, deliquescent, bitter, saline, sulphurous taste; used like sodium and magnesium sulphites, to which it is inferior. Dose, as a laxative, ʒij–4 (8–15 Gm.).

10. *Potassii Tartras. Potassium Tartrate,* $K_2C_4H_4O_6,H_2O$, U.S.P. 1820–1880.—Obtained by gradually adding to a solution of potassium carbonate (preferably bicarbonate) acid potassium tartrate until neutral, filtering, concentrating, setting aside to crystallize—$2KHC_4H_4O_6 + K_2CO_3 = 2K_2C_4H_4O_6,H_2O + CO_2$. Diuretic, purgative, aperient; more gentle than sodium or magnesium sulphate; hepatic and portal congestion, hemorrhoidal swellings, febrile diseases. Dose, ʒj–8 (4–30 Gm.).

SODIUM (Natrium).

$Na^i = 23.$

The metallic element sodium (L. *sod-a*, + *ium*, fr. *solidus*, contr. *sodo*, solid, hard, *sod-ash*, residue from burning masses or *sods* of marine plants) is not itself official, but many of its salts are. It is diffused widely in nature in the form of various compounds, occurring in the atmosphere, soil, spring- and sea-waters, rock and common salt, mainly as the chloride; there is also the native nitrate and silicate, all being more abundant and soluble than potassium salts, and, like them, dissolved by rain-water, which, in its onward movement, dissolves and deposits some of them almost everywhere. The metal is obtained similarly to potassium (heating carbonate with carbon, etc.), with which it is distributed universally.

Tests for Sodium Salts: 1. Sodium salts are all soluble in water, consequently cannot be precipitated by any reagent. 2. The main test is that all compounds impart a yellow color to a colorless Bunsen flame, and the spectroscope gives a characteristic yellow line. 3. Sodium compounds are white, soluble in water, and non-volatile at a red heat.

Sodii Boras. Sodium Borate, $Na_2B_4O_7.10H_2O$, *U.S.P.*—(Syn., Sod. Bor., Borax, Sodium Tetraborate (Pyroborate), Sodæ Biboras, Sodium Biborate, Natrium Biboricum (Biboracicum), Boras Sodicus; Fr. Borate de Soude, Sel de Perse; Ger. Borax, Borsaures Natron, Natrium (pyroborat)-borat.)

Manufacture: This salt, natively called tincal, is found in Thibet, Persia, California, etc., occurring as a saline incrustation on lake shores and as crystals in the blue mud of Clear Lake. The large crystals are picked out, washed with sodium hydroxide solution to remove fatty matter, and the saturated earth lixiviated, the solution evaporated and crystallized; may also be made from the natural borates—boracite, borosodocalcite, cryptomorphite, etc., of Nevada, S. America, Europe, Asia. Mostly prepared from crude boric acid of Tuscany by fusing with sodium carbonate—$4H_3BO_3 + Na_2CO_3 = Na_2B_4O_7 + CO_2 + 6H_2O$. It is in colorless, transparent, monoclinic prisms, white powder, odorless, sweetish, alkaline taste, efflorescent in warm, dry air, soluble in water (15), boiling water (.6), glycerin (1), insoluble in alcohol; contains 52.32–54.92 p. c. of anhydrous sodium borate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. When heated—at first loses part of water of crystallization, then melts, swells, forming white, porous mass; at red heat—loses all water of crystallization, fusing to colorless glassy mass or bead. 2. Produces intense yellow flame, while a borax bead on platinum wire, dipped in glycerin, gives a transient bright green flame. 3. Aqueous solution (1 in 20) alkaline, turns turmeric paper reddish-brown, but if solution acidified with hydrochloric acid, turmeric paper remains unchanged at first, but brownish-red on drying, and greenish-black on moistening with ammonia water. *Impurities:* Heavy metals, arsenic, carbonate, bicarbonate. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

Fig. 454. — Sodium borate crystal.

Preparations.—1. *Unguentum Aquæ Rosæ*, .5 p. c. 2. *Liquor Sodii Boratis Compositus*, Dobell's Solution. *N.F.*, 1.5 p. c., sod. bor. 1.5 Gm., sod. bicarb. 1.5, phenol liq. $\frac{3}{10}$, glycerin 3.5, water q. s. 100 cc. 3. *Mel Sodii Boratis*, *N.F.*, 10 p. c. + glycerin 5, honey q. s. 100. 4. *Mel Rosæ et Sodii Boratis*, *N.F.*, 10 p. c., + glycerin 5, honey of rose q. s. 100. 5. *Liquor Aromaticus Alkalinus*, *N.F.*, 2 p. c., + pot. bicarb. 2, thymol $\frac{1}{20}$, methyl salicylate $\frac{1}{20}$, eucalyptol $\frac{1}{10}$, cudbear $\frac{1}{5}$, alcohol 5, glycerin 10, mag. carb. 1, water q. s. 100.

Unoff. Preps.: Glycerinum Boracis (Br.), $16\frac{2}{3}$ p. c. *Sodii Boro-Benzoas*, 43 p. c., + sodium benzoate 57 p. c.

Properties and Uses.—Identical with boric acid, disinfectant, antiseptic, astringent; large doses produce vomiting, purging, depres-

sion, feeble circulation, eruption, exfoliation, death (rare)—dysmenorrhea, uric acid diathesis, epilepsy, gravel; locally in aphthous ulceration, diphtheria, inflammation of the mouth, infantile diarrhea, cystitis, ulcers, urethral and vaginal inflammations, scaly skin diseases (psoriasis, impetigo, eczema, etc.), prurigo pudendi, leucorrhea, itching in urticaria, pruritus scroti et ani, conjunctivitis, gonorrhea.

Incompatibles: Precipitates alkaloids, atropine, cocaine, morphine, quinine, etc., except in presence of glycerin, gelatinizes acacia mucilage, decomposes alkali carbonates with effervescence, in presence of glycerin.

Sodii Chloridum. Sodium Chloride, NaCl, *U.S.P.*—(Syn., Sod. Chlorid., Common (Table, Sea) Salt, Muriate of Sodium, Sal (Commune) Culinare, Chloruretum Sodicum; Fr. Chlorure de Sodium, Hydrochlorate de Soude, Sel de Cuisine, Sel commun or marin; Ger. Natrium chloratum (purum), Natriumchlorid, Chlornatrium, Kochsalz.)

Manufacture: The most abundant sodium compound, found native everywhere, but, for general use, obtained from crystalline rock-salt, which is mined extensively, sea-water and brine of salt-wells, these natural solutions furnishing by evaporation the largest supply. It is in colorless, transparent, cubical crystals, white, crystalline powder, odorless, purely saline taste, slightly hygroscopic (due to magnesium chloride); soluble in water (2.8), boiling water (2.7), glycerin (10), slightly in alcohol; aqueous solution (1 in 10) neutral; contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated above 100° C. (212° F.)—decrepitates; at red heat—fuses; at white heat—slowly volatilizes and partly decomposed; produces intense yellow flame. 2. Aqueous solution (1 in 20) with silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. *Impurities:* Heavy metals, calcium, magnesium, bromide, iodide. Should be kept in well-closed containers. Dose, cathartic, ʒij–4 (8-15 Gm.); emetic, ʒss–1 (15–30 Gm.), in warm water.

Preparations.—1. *Liquor Sodii Chloridi Physiologicus.* Physiological Solution of Sodium Chloride. (Syn., Liq. Sod. Chlor. Physio., Physiological Salt Solution, Normal Saline Solution.)

Manufacture: Dissolve sodium chloride 8.5 Gm. in freshly distilled water q. s. 1000 cc., filter, transfer solution to sterile flask of insoluble glass, 1000 cc. capacity, stopper with plug of purified absorbent cotton, wrapped in gauze; fasten stout, non-absorbent paper or tinfoil over top of plug and lip of container, and sterilize in an autoclave under steam pressure of 115° C. (239° F.) for 30 minutes. If for intravenous injection—use solution within 24 hours, otherwise 1 month, the solution preferably being sterilized after each opening. Dose, ʒviij–64 (240–2000 cc.), repeated if necessary in a few hours—in lax tissues. 2. *Liquor Pancreatini, N.F.*, ½ p. c. 3. *Liquor Procainæ Hydrochloridi, N.F.*, $\frac{92}{100}$ p. c. 4. *Lotio Ammoniacalis Camphorata, N.F.*, 6 p. c. 5. *Salia Effervescentia, N.F.* (3).

Properties and Uses.—Stomachic, tonic, anthelmintic, antiperiodic, condiment, preservative; large doses produce vomiting, diarrhea, and when long continued—scurvy; base of the sodium preparations; intermittent fever, hemoptysis, phthisis, scrofula, diphtheria, dyspepsia, cholera, worms (ascarides), diabetes, albuminuria, to prevent alcoholic intoxication, congestion of the brain, epilepsy, emetic for narcotics and poisons in stomach—antidote to silver nitrate, nasal catarrh, ulcers, sore mouth, pruritus, insect-sting, toothache, swellings, bruises, rheumatism, salt-baths, stimulant, for headache, uterine pain, eczema, psoriasis. Liquor—injected intravenously (subcutaneously to replace loss of blood by venesection in uremia, systemic intoxication, collapse, drug narcosis, cholera, etc.

Sodii Indigotindisulphonas. Sodium Indigotindisulphonate, $[C_{16}H_8O_2N_2(SO_3Na)_2]$, *U.S.P.*—(Syn., Sod. Indigotin., Indigo Carmine, Ceruleinum; Fr. Indigo soluble, Indigodisulphonate de Sodium, Carmin d'indigo, Ceruleine; Ger. Indigosulfosaures Natrium.)

Manufacture: Add gradually, constantly stirring with glass rod, powdered indigo and ground glass each 1 Gm. to sulphuric acid 20 cc., heat 1 hour at 85° C. (185° F.), cool, add water, q. s. 1000 cc., filter from indigo-brown; mix filtered solutions and water each 50 cc., add sodium chloride 32 Gm., let stand 2 hours, filter, wash precipitate with brine 50 cc. This sodium salt of indigotindisulphonic acid is a blue powder, dark purple paste, which must be dried to constant weight before applying tests; sparingly soluble in water, yielding dark blue solution, almost insoluble in alcohol; when compressed acquires coppery luster. *Tests:* 1. Add to aqueous solution (1 in 200) nitric acid, bromine water, or chlorine water—blue color discharged; similar result when warmed with sodium hydroxide and zinc dust, or with stannous chloride T. S. 2. Dissolve 1 Gm. in distilled water 200 cc., filter through counterbalanced filters, wash filters and residue with distilled water until washings cease to be blue—dry insoluble residue on filter 2 p. c. *Impurities:* Iron ferricyanide, iron ferrocyanide, starch, starch iodide.

Properties and Uses.—As a dye, microscopic stain, "poison tablets $HgCl_2$," volumetric estimation of nitrates, chlorine.

Sodii Carbonas Monohydratus. Monohydrated Sodium Carbonate, $Na_2CO_3.H_2O$, *U.S.P.*—(Syn., Sod. Carb. Monohyd.; Fr. Carbonate de Soude monohydrate; Ger. Einfachwasserhaltiges Natriumkarbonat.)

Manufacture: By crystallizing ordinary sodium carbonate above 35° C. (95° F.), having the advantage of being comparatively stable and non-efflorescent. It is a white, crystalline, granular powder, odorless, strongly alkaline taste; exposed to air absorbs some moisture, to warm, dry air above 50° C. (122° F.) effloresces, at 100° C. (212° F.) —anhydrous; soluble in water (3), boiling water (1.8), glycerin (7), insoluble in alcohol; contains 99.5 p. c. of pure salt. *Tests:* 1. Aqueous

solution (1 in 10) strongly alkaline; effervesces with acids; produces intensely yellow flame. *Impurities:* Heavy metals, water, etc. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), in powder or some bitter infusion.

PREPARATIONS.—1. *Liquor Sodæ Chlorinatæ,* 7 p. c. 2. *Massa Ferri Carbonatis,* 46 p. c.—35 p. c. ferrous carbonate. 3. *Suppositoria Glycerini,* 1 gr. (.06 Gm.) or sodium stearate $3\frac{1}{2}$ gr. (.02) Gm.—6.5 p. c. 4. *Ferri Oxidum Saccharatum, N.F.,* 11.2 p. c. 5. *Linimentum Saponato-Camphoratum, N.F.,* 1 p. c. 6. *Salia Effervescentia, N.F.,* (1).

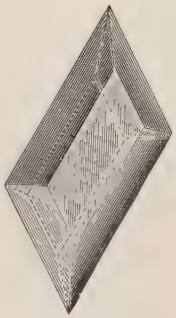


FIG. 455.—Sodium carbonate crystal.

PROPERTIES.—Antacid, irritant, diuretic. Similar to bicarbonate, not much used internally, owing to its corrosive and poisonous action (like sodium hydroxide).

USES.—Gallstones, acidity of stomach or intestines, uric acid diathesis (gout), rheumatism, skin diseases, burns, scrofula, whooping-cough, liver congestion, vulvar pruritus, for making other sodium salts.

Poisoning: As for potassium hydroxide. Give fixed oils, acetic acid, vinegar, lemon juice, demulcents, relieve pain with opium or morphine.

Sodii Bicarbonas. Sodium Bicarbonate, $NaHCO_3$, *U.S.P.*—(Syn., Sod. Bicarb., Natrium Carbonicum Acidulum, Bicarbonas Sodicus, Sodium Hydrocarbonate, Acid Sodium Carbonate; Fr. Bicarbonate de Soude, Sel digestif de Vichy; Ger. Natrium bicarbonicum, Natriumbikarbonat, Doppeltkohlensaures Natron.)

Manufacture: 1. Treat sodium carbonate (crystals or solution) with carbon dioxide—$(Na_2CO_3 + 10H_2O) + CO_2 = 2NaHCO_3 + 9H_2O$; 2. *Solvay's Ammonia-soda Process:* Mix concentrated solution of sodium chloride with ammonia, and saturate with carbon dioxide under pressure—$NaCl + NH_3 + CO_2 + H_2O = NaHCO_3 + NH_4Cl$; here ammonium chloride remains in solution and sodium bicarbonate is precipitated, but contaminated with ammonium salts which are difficult to remove. It is a white, opaque powder, odorless, cooling, mildly alkaline taste, permanent, slowly decomposes in moist air, soluble in water (10), insoluble in alcohol, aqueous solution (1 in 20) slightly alkaline, increasing on standing, agitation, heating; contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated—decomposes into normal sodium carbonate, water, carbon dioxide; at 100° C. (212° F.)—loses 36.5 p. c.; at bright red heat—residue fuses; produces intense yellow flame; no odor of ammonia on heating in test-tube. 2. Aqueous solution (1 in 20)—clear, colorless, effervesces strongly with acids; heated above 15° C. (59° F.)—gradually loses carbon dioxide; at boiling—entirely converted into normal sodium carbonate. *Impurities:* Heavy metals, carbonate. Should be kept cool, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

Preparations. -1. *Ferri Carbonas Saccharatus*, 35 p. c. 2. *Potassii Citras Effervescens*, 47.7 p. c. 3. *Pulvis Effervescens Compositus*, 38¾ gr. (2.5 Gm.). 4. *Sodii Phosphas Effervescens*, 47.7 p. c. 5. *Tabellæ Sodii Bicarbonatis*, Soda Mint Tablets, *N.F.*, 4 gr. (.25 Gm.), each. 6. *Liquor Sodæ et Menthæ*, Soda Mint, *N.F.*, 5 p. c.,+ sp. ammon. arom. 2 p. c., spearmint (peppermint) water q. s. 100. Dose, ʒj–2 (4–8 cc.). 7. *Liquor Sodii Boratis Compositus*, *N.F.*, 1.5 p. c. 8. *Liquor Sodii Citratis*, *N.F.*, 2.5 p. c., + citric acid 2, aq. dest. q. s. 100. Dose, ʒj–2 (4–8 cc.). 9. *Elixir Catariæ et Fœniculi*, *N.F.*, 1¾ p. c. 10. *Elixir Hydrastis Compositum*, *N.F.*, $\frac{8.75}{1000}$ p. c. 11. *Glyceritum Bismuthi*, *N.F.*, 33.4 p. c. 12. *Liquor Pancreatini*, *N.F.*, 5 p. c. 12. *Mistura Rhei Composita*, *N.F.*, 3.5 p. c. 14. *Pulvis Acetanilidi Compositus*, *N.F.*, 20 p. c. 15. *Pulvis Pancreatini Compositus*, *N.F.*, 80 p. c. 16. *Salia Effervescentia*, *N.F.*, (8).

Properties.—Antacid, diuretic, slight depressant and sedative.

Uses.—Similar to potassium bicarbonate, but more slowly absorbed; dyspepsia, calculus, infantile croup, pneumonia, gravel, suppressed urine, diabetes, acute articular rheumatism, angina, pruritus, tonsillitis, ophthalmia, rhus toxicodendron poisoning, pain from burns, to dissolve diphtheritic membrane.

Incompatibles: Acids, acid salts, bismuth subnitrate.

Sodii Hydroxidum. Sodium Hydroxide, NaOH, *U.S.P.*—(Syn., Sod. Hydrox., Caustic Soda, Sodium Hydrate, Soda, U.S.P. 1890, Soda Caustica, Natrium (Causticum) Hydricum; Fr. Soude caustique; Ger. Natron, Ätznatron.)

Manufacture: (1) Decompose a solution of sodium carbonate with milk of lime, evaporate filtrate, congeal in molds; (2) allow metallic sodium to act on water—$Na + H_2O = NaOH + H$; (3) evaporate liquor sodii hydroxidi, pour into molds. It is in dry, white, nearly white, fused masses, sticks, hard, brittle, showing crystalline fracture (must exercise great caution in its use, as it rapidly destroys organic tissues), deliquescent, absorbs carbon dioxide becoming coated with carbonate, soluble in water (.9), boiling water (.3), alcohol; solution, even greatly diluted, strongly alkaline, produces intensely yellow flame; contains 90 p. c. of pure base. *Impurities:* Heavy metals, potassium, organic matter, insoluble substances. Should be kept in well-closed containers, and if these are bottles they must be of hard glass. Dose, gr. 1–2 (.06–.13) Gm.), well diluted.

Preparations. -1. *Liquor Sodii Hydroxidi.* Solution of Sodium Hydroxide. (Syn., Liq. Sod. Hydrox., Liquor Sodæ, Solution of Soda, Solution of Sodium Hydrate, Natrium Hydricum Solutum, Solution of Caustic Soda; Fr. Soude caustique liquide, Lessive des Savonniers; Ger. Liquor Natri caustici, Ätznatronlauge.)

Manufacture: 5 p. c. Mix dekanormal solution of sodium hydroxide 12.5 cc. (or 5.6 Gm. 90 p. c. NaOH) with distilled water q. s. 100 cc. It is a clear, colorless, odorless, aqueous liquid (solution), very acrid,

caustic taste (even if largely diluted, when it only should be tasted), strongly alkaline, readily absorbs carbon dioxide from the air, sp. gr. 1.056; contains not less than 4.5–5.5 p. c. of sodium hydroxide. *Impurities:* Carbonate, etc. Should be kept in bottles made of hard glass, with rubber stoppers, or glass stoppers coated with petrolatum. Dose, ♏v–30 (.3–2 cc.), well diluted.

Unoff. Prep.: Soda cum Calce, (Soda-lime), 50 p. c., + calcium oxide 50.

Properties.—Strong escharotic, destroys tissue like potassium hydroxide, and otherwise just like it only not quite so poisonous.

Poisoning, Incompatibles: Same as for potassium hydroxide.

Sodii Acetas. Sodium Acetate, $NaC_2H_3O_2\,3H_2O$, *U.S.P.*—(Syn., Sod. Acet., Acetas Sodicus (Natricus), Terra Foliata Tartari (Crystallisata); Fr. Acétate de Soude; Ger. Natrium aceticum, Natriumazetat, Essigsaures Natron.)

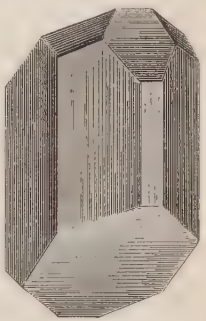


Fig. 456.—Sodium acetate crystal.

Manufacture: Neutralize acetic acid with sodium carbonate or bicarbonate, evaporate, crystallize—$Na_2CO_3 + 2HC_2H_3O_2 = 2NaC_2H_3O_2 + H_2O + CO_2$, or from acetic acid in purifying wood vinegar. It is in colorless, transparent, monoclinic prisms, granular, crystalline powder, odorless, cooling, saline taste, efflorescent, soluble in water (.8), alcohol (19); aqueous solution (1 in 20) neutral, slightly alkaline; contains 59.97–62.96 p. c. of anhydrous sodium acetate, corresponding to 99.5 p. c. of crystallized salt. *Tests:* 1. Begins to liquefy at 58° C. (137° F.), becomes dry and anhydrous at 120° C. (248° F.), at higher temperature decomposes with inflammable, empyreumatic vapors, and black residue of sodium carbonate and carbon, which gives intense yellow flame, is alkaline and effervesces with acids. 2. Add .1 Gm. to sulphuric acid and alcohol each 1 cc., warm—ethyl acetate, recognized by odor. *Impurities:* Heavy metals, arsenic, potassium. Should be kept in well-closed containers. Dose, gr. 15–60 (1–4 Gm.).

Properties and Uses.—Diuretic, rarely used in medicine, but to distil with sulphuric acid for acetic acid.

Sodii Citras. Sodium Citrate, $Na_3C_6H_5O_7.2H_2O$, *U.S.P.*—(Syn., Sod. Cit., Natrium Citricum; Fr. Citrate de Sodium (Soude); Ger. Natriumzitrat, Citronensaures Natron.)

Manufacture: Neutralize a solution of citric acid with sodium carbonate or bicarbonate, concentrate, crystallize. It is in small crystals, a white, granular powder, odorless, cooling, saline taste, soluble in water (1.3), boiling water (.6), insoluble in alcohol; aqueous solution (1 in 20) slightly alkaline to litmus, not reddened by 1 drop of phenolphthalein T. S.; contains 98 p. c. of pure salt. *Tests:* 1.

Heat to 150° C. (302° F.)—loses all water of crystallization; ignite at red heat—carbonizes, emitting inflammable gases of pungent, acrid odor; residue—alkaline, strongly effervescing with acids. 2. Aqueous solution (1 in 20) and calcium chloride T. S., each 10 cc.—liquid clear until boiled, then have a white, granular precipitate. *Impurities:* Heavy metals, arsenic, tart ate. Should be kept in well-closed containers. Dose, diuretic, antilithic, gr. 10–45 (.6–3 Gm.); mild laxative, ʒss–1 (15–30 Gm.).

Preparations.—1. *Glyceritum Phenolis,* 1 p. c. 2. *Elixir Gentianæ, N.F.,* 3 p. c. 3 *Liquor Ferri Peptonati, N.F.,* 2 p. c. 4. *Liquor Phosphatum Compositus, N.F.,* 3.5 p. c. 5. *Syrupus Hypophosphitum Compositus, N.F.,* $\frac{3.75}{1000}$ p. c. 6. *Tinctura Ferri Citrochloridi, N.F.,* 45 p. c.

Properties and Uses.—Diuretic, antilithic, mild laxative; to prevent curds in infants' milk, etc. Similar to but weaker than potassium citrate.

Sodii Benzoas. Sodium Benzoate, $NaC_7H_5O_2$; if in crystals, $NaC_7H_5O_2,H_2O$, *U.S.P.*—(Syn., Sod. Benz., Benzoas Sodicus; Fr. Benzoate de Soude; Ger. Natrium benzoicum, Natriumbenzoat.)

Manufacture: Add sodium bicarbonate (7) to benzoic acid (10) suspended in hot water (20), after carbon dioxide evolved neutralize liquid, evaporate filtrate, frequently stirring (13.5)—$Na_2CO_3 + 2HC_7H_5O_2 = 2NaC_7H_5O_2 + H_2O + CO_2$. It is a white, amorphous, granular or crystalline powder, odorless, sweetish taste, permanent, soluble in water (1.8), boiling water (1.4), alcohol (61); contains when dried to constant weight 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 10) neutral, slightly alkaline; with diluted sulphuric acid 5 cc.—white precipitate (benzoic acid). 2. When heated —vapors have odor of benzoic acid, then chars with a residue of sodium carbonate and carbon; produces intensely yellow flame. 3. Concentrated aqueous solution with diluted hydrochloric or sulphuric acid—voluminous, white precipitate (benzoic acid). *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Properties and Uses.—Similar to benzoic acid—antiseptic; disinfects and renders alkaline urine—acid; gout, rheumatism, phthisis, diphtheria, lithemia, lithemic gravel, puerperal fever; harmless—preservative for canned goods, catsup, etc.

Sodii Bromidum. Sodium Bromide, NaBr, *U.S.P.*—(Syn., Sod. Brom., Bromuretum Sodicum; Fr. Bromure de Sodium; Ger. Natrium bromatum, Natriumbromid, Bromnatrium.)

Manufacture: Similar to potassium bromide, using sodium hydroxide or sodium carbonate with bromine, or by double decomposition between ferrous bromide and sodium carbonate—$Na_2CO_3 + FeBr_2 = 2NaBr + FeCO_3$. It is in colorless, white, cubical crystals, white, granular

powder, odorless, saline taste, absorbs moisture from air without deliquescing, soluble in water (1.1), alcohol (16); aqueous solution (1 in 20) neutral, faintly alkaline; contains, when dried to constant weight, 98.5 p. c. of pure salt. *Tests:* 1. Heat to bright red, 760° C. (1400° F.)—fuses without decomposition, at higher temperature volatilizes; produces intense yellow flame. 2. Aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, or excess of ammonia water. *Impurities:* Heavy metals, alkali, barium, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.), in water, elixir, syrup, or powder.

Preparations.—1. *Elixir Sodii Bromidi, N.F.*, 17.5 p. c., + syrup 20 p. c., aq. dest. 46, elix. arom. q. s. 100. Dose, ʒj–2 (4–8 cc.). 2. *Elixir Bromidorum Quinque, N.F.*, $8\frac{3}{4}$ p. c. 3. *Elixir Bromidorum Trium, N.F.*, 8 p. c. 4. *Elixir Euphorbiæ Compositum, N.F.*, 3.5 p. c. 5. *Syrupus Bromidorum, N.F.*, 8 p. c.

Properties and Uses.—Similar to those of potassium bromide, but less irritating to the stomach, and a weaker depressant. Epilepsy, insomnia, delirium tremens, nervous palpitation, nervousness at menopause, sea-sickness.

Poisoning, Incompatibles, Synergists: See Potassium Bromide, page 715.

Sodii Iodidum. Sodium Iodide, NaI, *U.S.P.*—(Syn., Sod. Iod.; Fr. Iodure de Sodium; Ger. Natrium jodatum (jodid), Jodnatrium, Natrium iodatum.)

Manufacture: Add iodine to a solution of sodium hydroxide (or sodium carbonate), or by double decomposition between ferrous iodide and sodium carbonate—$(Na_2CO_3 + 10H_2O) + FeI_2 = 2NaI + FeCO_3 + 10H_2O$. It is in colorless, cubical crystals or white crystalline powder, odorless, saline taste, deliquescent, at first caking, often decomposes, assuming brown tint, soluble in water (.55), boiling water (.4), alcohol (2), glycerin (1); aqueous solution (1 in 20) neutral, slightly alkaline; contains not more than 7 p. c. of moisture, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated to 660° C. (1220° F.)—melts; at bright red heat—slowly volatilizes, partly decomposed; produces intense yellow flame. 2. Add to 5 cc. of aqueous solution (1 in 20) ferric chloride T. S. and distilled water, each 1 cc., shake, add 5 cc. of chloroform—latter violet color. *Impurities:* Heavy metals, barium, potassium, alkali, cyanide, iodate, nitrate, nitrite, sulphate, thiosulphate, water. Should be kept in well-closed containers. Dose, gr. 2–30 (.13–2 Gm.), ter die, in water, elixir, syrup.

Properties and Uses.—Same as potassium iodide, only is less depressing and irritating. Constitutional syphilis, chronic eczema; with arsenic in lepra, psoriasis, also as a stimulant and antiseptic in foul ulcers, sores, fetor in general.

Poisoning, Incompatibles: See Iodine, page 705.

Sodii Salicylas. Sodium Salicylate, $NaC_7H_5O_3$, *U.S.P.*—(Syn., Sod. Salicyl.; Fr. Salicylate de Soude; Ger. Natrium salicylicum, Natriumsalizylat.)

Manufacture: Neutralize salicylic acid (16.5) with sodium bicarbonate (10), in distilled water (10), after effervescence, evaporate solution at 60° C. (140° F.) to dryness—$Na_2CO_3 + 2HC_7H_5O_3 = 2NaC_7H_5O_3 + H_2O + CO_2$; solution must remain slightly acid, as alkali salicylates having excess of alkali absorb oxygen and become colored. It is a white, microcrystalline powder, scales, amorphous powder, colorless, faint pink tinge, odorless, faint characteristic odor, sweet, saline taste, soluble in glycerin (4), water (.9), alcohol (.92), very soluble in boiling water, boiling alcohol; aqueous solution (1 in 10) when fresh colorless, nearly colorless, neutral, slightly acid; contains, when dried to constant weight, 99.5 p. c. of pure salt. *Tests:* 1. When heated—decomposes, giving off inflammable vapors, phenol odor, and residue of sodium carbonate and carbon; produces intensely yellow flame. 2. Excess of concentrated aqueous solution (1 in 4) with a few drops of ferric chloride T. S.—dark red color and precipitate, with hydrochloric acid or sulphuric acid—voluminous white precipitate; solution (1 in 100) produces deep violet-blue color. *Impurities:* Heavy metals, sulphite, thiosulphate. Should be kept from heat and light, in well-closed containers. Dose, gr. 15–30 (1–2 Gm.), ter die, in elixir, water.

Preparations.—1. *Caffeinæ Sodio-Salicylas, N.F.*, 50 p. c. 2. *Elixir Sodii Salicylatis, N.F.*, 8.5 p. c., + syrup, 20, aq. dest. 46, elix. arom. q. s. 100. Dose, ʒj–2 (4–8 cc.). 3. *Elixir Sodii Salicylatis Compositum, N.F.*, 8 p. c., + fldext. cimicif. 3.2, fldext. gelsem. 1.6, pot. iod. 1.5, elix. arom. q. s. 100. Dose, ʒss–1 (2–4 cc.). 4. *Elixir Tongæ et Salicylatum, N.F.*, 7 p. c. 5. *Elixir Manacæ Compositum, N.F.*, 14 p. c. 6. *Liquor Ferri Salicylatis, N.F.*, 12.5 p. c.

Properties and Uses.—Same as salicylic acid (page 896), but not so irritating, and is absorbed more rapidly; it lowers temperature, lessens pain; rheumatism, neuralgia, tonsillitis, dysmenorrhea, pruritus, whooping-cough, migraine, cholera infantum, diarrhea, variola, orchitis, rheumatic iritis, biliary colic, acute pleurisy, sciatica, to prevent formation of gallstones, diabetes.

Sodii Sulphas. Sodium Sulphate, $Na_2SO_4.10H_2O$, *U.S.P.*—(Syn., Sod. Sulph., Glauber's Salt, Sulfas Sodicus (Natricus); Fr. Sulfate de Soude, Sel de Glauber; Ger. Natrium sulfuricum, Natriumsulfat, Glaubersalz.)

Manufacture: As a by-product in making soda-ash, hydrochloric acid, nitric acid, ammonium chloride, carbonated waters, etc.; neutralize residue thus left with sodium carbonate, filter, evaporate, crystallize—$2NaHSO_4 + Na_2CO_3 = 2Na_2SO_4 + CO_2 + H_2O$. It is in large, colorless, transparent, monoclinic prisms, or granular crystals, odorless, bitter, saline taste, effloresces rapidly in air, soluble in water (1), glycerin, insoluble in alcohol; aqueous solution (1 in 10) neutral;

contains 43.64–48 p. c. of anhydrous sodium sulphate, Na_2SO_4, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat to 33° C. (92° F.)—melts in its water of crystallization; heat gently—fuses; at 100° C. (212° F.)—loses all water of crystallization (56 p. c.); at red heat—anhydrous salt fuses without decomposition; produces intensely yellow flame. 2. Aqueous solution (1 in 20) with barium chloride T.S. —white precipitate, insoluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic. Should be kept cool, in well-closed containers. Dose, purgative, ʒij–8 (8–30 Gm.).

Preparation.—1. *Salia Effervescentia, N.F.* (1).

Properties and Uses.—Hydragogue cathartic, diuretic; the strongest sodium purgative. When effloresced (dehydrated) it is twice as strong, hence dose should be only one-half. Largely used in veterinary practice, but for man is so harsh that magnesium sulphate almost always is substituted. Used in constipation, plethora, typhoid fever, dysentery, gastric ulcers, to neutralize phenol (carbolic acid) corrosion, to make sodium carbonate and glass. The bitter, nauseous taste may be overcome by flavoring with aromatic syrup, lemon, etc.

Sodii Phosphas. Sodium Phosphate, $Na_2HPO_4.12H_2O$, *U.S.P.*—(Syn., Sod. Phos., Sodium Orthophosphate, Phosphas Sodicus (Natricus), Disodium Hydrogen Phosphate; Fr. Phosphate de Soude; Ger. Natrium phosphoricum, Natriumphosphat, Phosphorsaures Natron.)

Manufacture: Digest bone-ash with H_2SO_4, which forms acid calcium phosphate—$Ca_3(PO_4)_2 + 2H_2SO_4 = Ca(H_2PO_4)_2 + 2CaSO_4$; filter, heat, add sodium carbonate to the solution, evaporate filtrate, crystallize—$Ca(H_2PO_4)_2 + 2Na_2CO_3 = 2Na_2HPO_4 + CaCO_3 + H_2O + CO_2$. It is in large, colorless, monoclinic prisms or granular, crystalline salt, odorless, cooling, saline taste, efflorescent, soluble in water (2.7), slightly soluble in alcohol; aqueous solution (1 in 10) alkaline; contains 39.25–44.00 p. c. of anhydrous sodium di-ortho-phosphate, Na_2HPO_4, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heated above 40° C. (104° F.)—fuses, yielding colorless liquid; at 100° C. (212° F.)—loses all water of crystallization; at red heat, 300° C. (572° F.)—converted into sodium pyrophosphate. 2. Aqueous solution (1 in 20) with magnesium mixture T. S.—white, crystalline precipitate; produces intensely yellow flame. *Impurities:* Heavy metals, arsenic, calcium, aluminum, carbonate, chloride, sulphate. Should be kept in well-closed containers. Dose, alterative, gr. 20–40 (1.3–2.6 Gm.); purgative, ʒij–6 (8–24 Gm.).

Preparations.—1. *Sodii Phosphas Exsiccatus.* Exsiccated Sodium Phosphate. (Syn., Sod. Phos. Exsic., Natrium Phosphoricum Exsiccatum, Dried (Anhydrous) Sodium Phosphate; Fr. Phosphate de Soude desséché; Ger. Getrocknetes Natriumphosphat.)

Manufacture: Allow sodium phosphate crystals 100 Gm. to effloresce several days in warm air at 25–30° C. (77–86° F.), continue the drying in an oven, gradually increasing the heat to 100° C. (212° F.), until

salt ceases to lose weight; powder and sift. It is a white powder which absorbs moisture readily, soluble in water (8.1), boiling water (1.1), insoluble in alcohol; contains, when dried to constant weight, 98 p. c. of pure salt. Should be kept in well-closed containers. Dose, gr. 10–60 (.6–4 Gm.).

Preps.: 1. *Sodii Phosphas Effervescens.* Effervescent Sodium Phosphate. (Syn., Sod. Phos. Eff., Natrium Phosphoricum Effervescens; Fr. Phosphate de Soude Effervescent; Ger. Brausendes Natriumphosphat.)

Manufacture: Mix powdered citric acid 16.2 Gm., with exsiccated sodium phosphate 20 Gm., tartaric acid 25.2 Gm., then incorporate sodium bicarbonate 47.7 Gm.; heat in an oven at 93–104° C. (199–219° F.); manipulate mixture carefully with wooden spatula until it becomes moist, rub through No. 6 tinned-iron sieve, dry granules at 54° C. (130° F.). Should be kept in well-stoppered (sealed) containers. Dose, ʒj–4 (4–15 Gm.).

2. *Liquor Sodæ Chlorinatæ Chirurgicalis*, 2–3.8 Gm. in each 100 cc.

2. *Liquor Sodii Phosphatis Compositus, N.F.*, 100 p. c.—Obtained by heating until liquefied sodium phosphate crystals 100 Gm., citric acid 13, adding glycerin 15, distilled water q. s. 100 cc. Dose, ʒj–2 (4–8 cc.) in water (hot) 1 hour before meals.

Properties and Uses.—Hepatic stimulant, mild purgative, alterative, scrofula, rachitis, diabetes, scrofulous ophthalmia, bowel complaint, diarrhea, jaundice, fevers.

Sodii Biphosphas. Sodium Biphosphate, $NaH_2PO_4.H_2O$, *U.S.P.*—(Syn., Sod. Biphos., Sodium Dihydrogen Phosphate, Monosodium Orthophosphate; Br. Sodii Phosphas Acidus, Monosodium Hydrogen Phosphate.)

Manufacture: To sodium phosphate (3) in solution add phosphoric acid (1) using molecular proportions, until a small portion shows no precipitation with barium chloride T. S., evaporate, crystallize (granulate)—$Na_2HPO_4 + H_3PO_4 = 2NaH_2PO_4$. It is in colorless, transparent crystals, white, granular, crystalline powder, odorless, slightly deliquescent, soluble in water, practically insoluble in alcohol, chloroform, ether; aqueous solution acid and produces effervescence with sodium carbonate; contains 98 p. c. of pure salt. *Tests:* 1. Heat at 100° C. (212° F.)—loses water of crystallization (13.04 p. c.), at 210° C. (410° F.)—converted into disodium dihydrogen pyrophosphate, $Na_2H_2P_2O_7$, at higher temperature—changed into mixture of sodium metaphosphate, $NaPO_3$, and its modifications. *Impurities:* Heavy metals, arsenic, aluminum, calcium, disodium phosphate, free acid, chloride, sulphate, water. Dose, 10–30 gr. (.6–2 Gm.).

Properties and Uses.—Laxative, diuretic; cystitis, increase acidity of urine; undergoes no change in stomach, but in the intestine becomes neutral phosphate; withdraws alkalinity (sodium carbonate)

from the blood thus producing acid urine; used previous to giving hexamethylenamine—active in acid media.

Sodii Cacodylas. Sodium Cacodylate, $Na(CH_3)_2AsO_2.3H_2O$, *U.S.P.*—(Syn., Sod. Cacodyl., Sodium Dimethylarsenate, Sodium Cacodylate; Fr. Cacodylate de Soude; Ger. Natrium kakodyl-icum(-at.)

Manufacture: Distil arsenous oxide with potassium acetate, oxidize distillate (cacodyl, $As_2(CH_3)_4$, and cacodyl oxide, $As_2(CH_3)_4O$), with mercuric oxide, neutralize cacodylic acid with solution of sodium hydroxide, concentrate to crystallization. It is in white, odorless, deliquescent prisms, granular powder, soluble in water (.5), alcohol (2.5); contains 72–75 p. c. of pure salt with variable amounts of water. *Tests:* 1. Melts in its water of crystallization at 60° C. (140° F.), becomes anhydrous at 120° C. (248° F.), burning with bluish flame of garlic-like odor. 2. Aqueous solution (1 in 100) few drops, + hypophosphorous acid T. S. 2 cc., let stand in stoppered tube—odor of cacodyl in an hour. *Impurities:* Heavy metals, monomethylarsenate, arsenate, chloride, phosphate, sulphate. Should be kept in well-closed containers. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.), in pill, enema, hypodermically.

Preparation.—1. *Ampullæ Sodii Cacodylatis, N.F.*, each gr. 5 (.3 Gm.). Dose, 1–3 ampuls.

Properties and Uses.—Alterative, hematic—similar to other arsenic compounds, but much less toxic and prone to undesirable effects, owing to slow liberation of arsenous acid in the body; psoriasis, leukemia, chlorosis, anemia, tuberculosis, malarial cachexia, diabetes, chorea, skin diseases.

Sodii Nitris. Sodium Nitrite, $NaNO_2$, *U.S.P.*—(Syn., Sod. Nitris; Fr. Nitrite de Soude; Ger. Natriumnitrit, Salpetrigsaures Natron.)

Manufacture: Heat together sodium nitrate, charcoal, and starch, wash out the nitrite with water; or, better, heat fused sodium nitrate (3 hours) with lead in thin sheets—$2NaNO_3 + Pb_2 = 2NaNO_2 + 2PbO$; lixiviate mass with water, treat solution with carbon dioxide (to remove trace of lead), crystallize filtrate. It is in white, nearly white, opaque, fused masses, sticks, colorless, transparent crystals, granular powder, odorless, mild saline taste, deliquescent, gradually oxidized to sodium nitrate, making it unfit for use, soluble in water (1.5), more so in boiling water, sparingly in alcohol; aqueous solution (1 in 20) slightly alkaline; contains, when dried to constant weight, 95 p. c. of pure salt. *Tests:* 1. When heated to 270° C. (518° F.)—melts; at red heat decomposes, yielding oxygen, nitrogen, nitrous oxides, sodium oxide; produces intensely yellow flame. 2. Mix 5 cc. of aqueous solution (1 in 10) with potassium iodide T. S. and hydrochloric acid, each 5 drops—iodine liberated, nitrogen dioxide escapes with effervescence. *Impurities:* Heavy metals, etc. Should be kept in well-closed containers. Dose, gr. 2–3 (.13–.2 Gm.), ter die.

Preparation.—1. *Spiritus Æthylis Nitritis.*

Properties and Uses.—Similar to nitroglycerin and amyl nitrite, but is milder and more uniform; angina pectoris, asthma, dyspnea, headache, hemicrania, epilepsy; dilates the vessels, lowers blood-pressure.

Sodii Thiosulphas. Sodium Thiosulphate, $Na_2S_2O_3.5H_2O$, *U.S.P.*—(Syn., Sod. Thiosulph., Sodium Hyposulphite, Hyposulphis Sodicus; Fr. Hyposulphite de Soude, Sulphite sulfuré de Soude; Ger. Natrium thiosulfuricum, Natriumthiosulfat, Natrium hyposulphurosum (subsulfurosum), Unterschwefligsaures Natron.)

Manufacture: By boiling solution sodium sulphite with sulphur—$Na_2SO_3 + S = Na_2S_2O_3$, or boiling $6NaOH + S_{12} = Na_2S_2O_3 + 2Na_2S_5 + 3H_2O$, or on larger scale by double decomposition of sodium carbonate with calcium thiosulphate—$Na_2CO_3 + CaS_2O_3 = Na_2S_2O_3 + CaCO_3$. This is not, as sometimes considered, a true hyposulphite ($NaHSO_2$) which, however, can be made thus: $3NaHSO_3 + Zn = NaHSO_2 + Na_2SO_3 + ZnSO_3 + H_2O$. It is in colorless, transparent, monoclinic prisms, odorless, cooling, bitter taste, permanent below 33° C. (92° F.), efflorescent above that in dry air, slightly deliquescent in moist air, soluble in water (.5), insoluble in alcohol, rapidly decomposed at boiling; aqueous solution (1 in 10) neutral, faintly alkaline; contains 63.07–67.48 p. c. of anhydrous sodium thiosulphate, corresponding to 99 p. c. of crystallized salt. *Tests:* 1. Heat rapidly—liquefies; heat slowly until effloresced, then to 100° C. (212° F.)—undergoes partial decomposition, loses all water of crystallization; at red heat 220° C. (428° F.)—decomposed, liberating sulphur, with residue of sodium sulphite and sulphate; produces intensely yellow flame. 2. Aqueous solution readily dissolves compounds of silver (bromide, chloride, iodide, oxide, etc.), and decolorizes solutions of iodine, or starch iodide; aqueous solution (1 in 10) 5 cc. with a few drops of ferric chloride T. S.—dark violet color, rapidly disappearing upon agitation. *Impurities:* Heavy metals, arsenic, calcium, sulphite, bisulphite. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), also in baths, ointments.

Fig. 457.—Sodium thiosulphate crystal.

Preparations.—1. *Liquor Potassii Iodidi, N.F.*, $\frac{1}{20}$ p. c. 2. *Unguentum Potassii Iodidi, N.F.*, 1 p. c.

Properties and Uses.—Antizymotic, antiseptic, germicide; parasitic skin diseases, especially pityriasis versicolor, fermentation indigestion, pyrosis; ulcers of tonsils, aphthous stomatitis, mucous patches; poison ivy.

Allied Salts:

1. *Sodii Arsenas. Sodium Arsenate,* $Na_2HAsO_4.7H_2O$, *N.F.*,—Obtained by heating arsenic trioxide (10), sodium nitrate (8.5), and dried sodium carbonate (5.5) to redness, dissolving fused mass in

water (35), crystallizing—$As_2O_3 + 2NaNO_3 + Na_2CO_3 = Na_4As_2O_7 + N_2O_3 + CO_2$. Upon the addition of water to the warm mass, one molecule is combined, thereby converting the sodium pyroarsenate into the orthoarsenate, and as such crystallizes upon standing—$Na_4As_2O_7 + 15H_2O = 2(Na_2HAsO_4.7H_2O)$. It is in colorless, transparent, monoclinic prisms; odorless, efflorescent, deliquescent, mild alkaline taste (use great care in tasting and then only in very dilute solutions), soluble in water (1.5), boiling water (1), slightly in alcohol, nearly insoluble in boiling alcohol; contains 58.98–61.92 p. c. of anhydrous sodium arsenate (di-sodium ortho-arsenate), corresponding to 99 p. c. of crystallized salt. Heat gently—loses 5 molecules of water, being converted into a white powder; at higher temperature—loses all water of crystallization; strongly heated—fuses, and at red heat—converted into pyroarsenate. Should be kept in well-closed containers. Properties, uses, poisoning same as for arsenic trioxide. Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.).

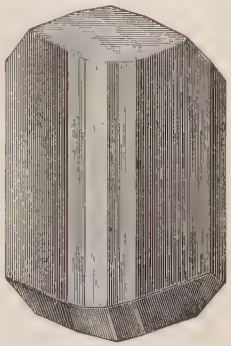


Fig. 458. — Sodium arsenate crystal.

Preps.: 1. *Sodii Arsenas Exsiccatus, Exsiccated Sodium Arsenate,* Na_2HAsO_4.—Obtained by breaking into small fragments sodium arsenate crystals 100 Gm., allowing them to effloresce at 40–50° C. (140–122° F.) until disintegrated, heating at 150° C. (302° F.) until product ceases to lose weight, pulverizing. It is an odorless, amorphous, white powder, slightly hygroscopic, mildly alkaline taste (use great care in tasting and then only in very dilute solutions), soluble in water (3.1), boiling water (1.3), slightly in alcohol, nearly insoluble in boiling alcohol; contains when dried to constant weight, 98 p. c. of pure salt. Aqueous solution (1 in 20) alkaline, produces intense yellow flame; aqueous solution with barium chloride T. S.—white precipitate, soluble in nitric acid; with silver nitrate T. S.—dark red precipitate, soluble in nitric acid. *Impurities:* Lead, copper, iron, arsenite. Should be kept in well-closed containers. Dose, gr. $\frac{1}{24}$–$\frac{1}{12}$ (.0025–.005 Gm.).

Preps.: 1. *Liquor Sodii Arsenatis, Solution of Sodium Arsenate,* 1 p. c. Obtained by dissolving exsiccated sodium arsenate 1 Gm. in distilled water q. s. 100 Gm.; this aqueous solution contains .975–1.025 p. c. of sodium arsenate, and while it is a substitute for Pearson's Solution, the latter, it should be remembered, is only one-tenth as strong as this liquor. Dose, ♏iij–6 (.2–.4 cc.), diluted. 2. *Liquor Sodii Arsenatis Dilutus,* Pearson's Solution of Sodium Arsenate $\frac{1}{10}$ p. c. Dissolve sod. arsen. exsic. .1 Gm. (1.5 gr.) in aq. dest, q. s. 100 cc. (℥$3\frac{1}{3}$). Dose, ♏xv–30 (1–2 cc.).

2. *Sodii Glycerophosphas. Sodium Glycerophosphate,* $Na_2C_3H_7PO_6$, *N.F.*—Obtained by neutralizing a solution of glycerophosphoric acid with sodium carbonate or bicarbonate, concentrating filtrate. It is in white, monoclinic plates, scales, white powder, saline taste, odorless, very soluble in water (cold, hot), nearly insoluble in alcohol; aqueous solution (1 in 20) alkaline; contains 68 p. c. of anhydrous salt. When strongly heated—decomposes, evolving inflammable vapors; at red heat—converted into sodium pyrophosphate. *Impurities:* Heavy metals, free alkali, phosphates, alcohol-soluble substances. Nervine, tonic, neurasthenia, deficient nutrition, Addison's disease; to supply phosphorus. Dose, gr. 5–10 (.3–.6 Gm.), ter die, in powder or subcutaneously; 1. *Elixir Calcii et Sodii Glycerophosphatum,* $1\frac{3}{4}$ p. c., sod. glycerophos. 1.75 Gm., calc. glycerophos. .875, acid phos. $\frac{4}{5}$ cc., glycerin 30, elix. arom. 30, aq. dest. q. s. 100 cc. 2. *Elixir Glycerophosphatum Compositum,* 3.5 p. c., sod. glycerophos. 3.5 Gm., calc. glycerophos. 1.6, ferr. glycerophos. $\frac{3}{10}$, mangan. glycerophos. sol. $\frac{1}{5}$, quin. hydrochl. $\frac{9}{100}$, strych. nit. $\frac{1}{87}$, acid. lac. 1, +. Dose, each, ʒj–2 (4–8 cc.). 3. *Elixir Terpini Hydratis et Creosoti Compositum,* .875 p. c.

3. *Sodii Hypophosphis. Sodium Hypophosphite,* $NaPH_2O_2.H_2O$, *N.F.*—Obtained by adding sodium carbonate to solution of calcium hypophosphite, filtering, evaporating, granulating—$Na_2CO_3 + Ca(H_2PO_2)_2 = 2NaH_2PO_2 + CaCO_3$; should evaporate cautiously to avoid the giving off of inflammable hydrogen phosphide. It is in small, colorless, transparent, rectangular plates of pearly luster, white granular powder, odorless, saline taste, deliquescent in moist air, soluble in water (1), boiling water (.15), glycerin, alcohol, boiling alcohol, slightly in dehydrated alcohol; aqueous solution (1 in 20) neutral, slightly alkaline; contains, when dried to constant weight, 98 p. c. of pure salt. When heated—first loses water of crystallization, then decomposes, evolving spontaneously inflammable hydrogen phosphide, which burns with bright yellow flame; aqueous solution (1 in 20) acidulated with hydrochloric acid and added, drop by drop with agitation, to excess of mercuric chloride T. S.—white precipitate (mercurous chloride); upon further adding aqueous solution—precipitate gray from reduction to metallic mercury; heat for 30 minutes aqueous solution (1 in 5) 5 cc. in test-tube with diluted hydrochloric acid .5 cc.—no offensive odor. *Impurities:* Heavy metals, arsenic, phosphate. Stimulates nervous system, aids digestion and nutrition; phthisis, chronic bronchitis, scrofula, syphilis, anemia, forms bone. Should be kept in well-closed containers, and dispensed cautiously, as explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.), ter die, in water, syrup, or mixture. 1. *Syrupus Calcii et Sodii Hypophosphitum,* 3.5 p. c., sod. hypos. 3.5 Gm., calc. hypophos. 3.5, acid hypophos. $\frac{15}{100}$, glycerin 5, sucrose 75, aq. dest. q. s. 100 cc. 2. *Syrupus Hypophosphitum,* 1.5 p. c. 3. *Syrupus Hypophosphitum Compositus,* $1\frac{3}{4}$ p. c. 4. *Liquor*

Hypophosphitum Compositus, $\frac{22}{100}$ p. c. 5. *Emulsum Olei Morrhuæ cum Hypophosphitibus*, $\frac{1}{2}$ p. c.

4. *Sodii Perboras. Sodium Perborate*, $NaBO_3.4H_2O$, *N.F.*—Obtained by mixing boric acid (248), sodium peroxide (78), adding these to cold water (2000), acidifying with sulphuric acid (or carbon dioxide), washing separated crystals with alcohol, drying at 58° C. (136° F.). It is in white, crystalline granules, powder, odorless, saline taste, stable in cool dry air, but decomposed, evolving oxygen in warm moist air, soluble in water; saturated aqueous solution alkaline, decomposes into metaborate and hydrogen dioxide, gradually evolving oxygen, more rapidly when solution warmed—$NaBO_3 + H_2O = H_2O_2 + NaBO_2$; contains 9 p. c. of available oxygen, corresponding to 86.5 p. c. of pure salt. Produces intensely yellow flame; turmeric paper moistened with acidulated (HCl) aqueous solution—brown, particularly on drying; on moistening dried test paper with ammonia water—color changed to greenish-black; shake aqueous solution (1 in 50) with diluted sulphuric acid each 1 cc., + few drops of potassium dichromate T. S., + ether 2 cc.—latter blue color. *Impurities:* Heavy metals, etc. Antiseptic, deodorant, bactericide; wounds, purulent sores, varicose ulcers, toilet preparations, bleaching, disinfecting; similar to hydrogen dioxide, with the advantage of yielding an alkaline solution; applied as dusting powder, or in 2 p. c. solution. Should be kept cool, in well-closed containers. Dose, gr. 1–2 (.06–.13 Gm.); 1. *Dentifricium*, Oxidizing Tooth Powder, 5 p. c., sod. perbor. 5 Gm., soap 5, sucrose 10, cret. præp. 40, calc. carb. præc. 40, +.

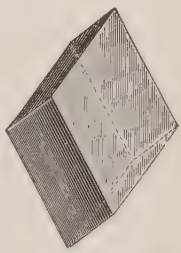


Fig. 459.—Sodium nitrate crystal.

5. *Sodii Nitras. Sodium Nitrate, Chile Saltpetre*, $NaNO_3$, U.S.P. 1870–1900.—Obtained natively in Chile, Peru etc., as a stratum (terra salitrosa) composed of various salts, from which the sodium nitrate is extracted by boiling water, crystallizing. It is in colorless, transparent rhombohedral crystals, odorless, cooling, saline, slightly bitter, hygroscopic, soluble in water (1.1), alcohol (100), at high heat evolves oxygen becoming nitrite, deflagrates with charcoal; contains 99 p. c. of pure salt. *Impurities:* Heavy metals, iodide. Refrigerant, diuretic, purgative; dysentery, epilepsy, angina pectoris, laryngitis, diarrhea. Should be kept in well-closed containers. Dose, purgative, during the day, ʒ4–8 (15–30 Gm.); for other conditions, gr. 15–30 (1–2 Gm.).

6. *Sodii Carbonas. Sodium Carbonate*, $Na_2CO_3.10H_2O$, U.S.P. 1820–1890.—Obtained by several processes: 1. *Leblanc's:* (1) $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$. (2) $Na_2SO_4 + 4C + CaCO_3 + \text{heat} = Na_2CO_3 + CaS + 4CO$; the resulting mass (black-ash) is washed with water, thereby dissolving out the sodium carbonate. 2. *Cryolite:* This mineral is found in Greenland, being the double fluoride of

aluminum and sodium. (1) $Al_2F_6 6NaF + 6CaCO_3 + \text{heat} = Al_2O_3 \cdot 3Na_2O + 6CaF_2 + 6CO_2$. (2) $Al_2O_3 3Na_2O + 3CO_2 + 3H_2O = 3Na_2CO_3 + 2Al(OH)_3$. The sodium aluminate is dissolved out by lixiviation with water, and into this solution CO_2 is passed, under pressure, which, decomposing, precipitates aluminum hydroxide together with a little Na_2CO_3, while most of the pure Na_2CO_3 remains in solution only to be crystallized out. 3. *Solvay's:* (1) $NaCl + 2NH_3 + 2CO_2 + 2H_2O$, under pressure $= NaHCO_3 + NH_4HCO_3 + NH_4Cl$. (2) $NH_4HCO_3 + NaCl = NaHCO_3 + NH_4Cl$. (3) $2NaHCO_3 + \text{heat} = Na_2CO_3 + H_2O + CO_2$. It is in colorless, monoclinic crystals, odorless, alkaline taste, effloresces, losing one-half of its water of crystallization (31.46 p. c. by weight), becoming a white powder; soluble in water (1.6), glycerin (1.02), insoluble in alcohol, ether. *Impurities:* Iron, lead, arsenic, aluminum, ammonia, calcium, potassium, sulphates, chlorides, sulphite, hyposulphite, sulphocyanate. Corrects acidity of system, increases liquidity of bile, diminishes solids; gall-stones, skin troubles, scaly, papulous (℥ij, + Oj water), burns—apply strong solution. *Poisoning:* Oils, lemon juice, vinegar. Should be kept in well-closed vessels. Dose, gr. 10–30 (.6–2 Gm.).

7. *Sodii Carbonas Exsiccatus. Dried Sodium Carbonate*, U.S.P. 1820–1900.—Obtained by exposing ordinary sodium carbonate 200 Gm., in broken crystals, for several days to warm air until effloresced and disintegrated; heat at 45° C. (113° F.) until reduced to 100 Gm. It is in loose white powder responding to reactions of monohydrated sodium carbonate. Dose, gr. 5–15 (.3–1 Gm.). Properties and uses same as preceding.

8. *Sodii Bisulphis. Sodium Bisulphite*, $NaHSO_3$, U.S.P. 1880–1900.—Obtained by saturating a solution of sodium carbonate (bicarbonate) with SO_2, crystallizing in a cool place—$Na_2CO_3 + 2H_2O + 2SO_2 = 2NaHSO_3 + H_2O + CO_2$. It is in opaque, prismatic crystals, granular powder, odor of SO_2, taste disagreeable, sulphurous; on exposure loses $SO = SO_2$, becoming oxidized into sulphate; soluble in water (3.5), alcohol (70); strongly heated decrepitates; contains 90 p. c. of pure salt. *Impurities:* Heavy metals, thiosulphate. Checks putrifaction, fermentation, yeasty vomiting, aphthous sore throat, neutralizes chlorine in bleaching fabrics and toxicological analysis. Should be kept cool, in small, well-filled, well-stoppered containers. Dose, gr. 5–30 (.3–2 Gm.).

9. *Sodii Chloras. Sodium Chlorate*, $NaClO_3$, U.S.P. 1880–1900.—Obtained by adding sodium carbonate crystals (9) to tartaric acid (9.5) in solution (hot), add this to potassium chlorate (8) in solution—(1) $Na_2CO_3 + 2H_2C_4H_4O_6 = 2NaHC_4H_4O_6 + H_2O + CO_2$. (2) $NaHC_4H_4O_6 + KClO_3 = NaClO_3 + KHC_4H_4O_6$. It is in colorless, transparent crystals (regular cubes with tetrahedral facets) or a crystalline powder, odorless, cooling, saline taste, permanent, soluble in water (1), glycerin (5), alcohol (100), melts when heated, giving off oxygen (45 p. c. by weight), leaving a residue of sodium chloride; contains 99 p. c.

of pure salt. *Impurities:* Lead, copper, potassium, etc. Properties and uses same as potassium chlorate, only more soluble, and therefore may be used in more concentrated solution. Should be kept in well-stoppered containers, and handled cautiously, as dangerous explosions may occur if heated, subjected to concussion or trituration with organic substances (cork, tannin, sugars, sulphur, antimony sulphide, phosphorus, gambir, catechu, glycerin, etc.). Dose, gr. 5–15 (.3–1 Gm.).

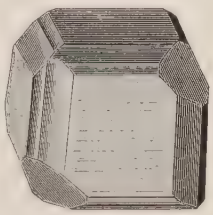


Fig. 460. — Sodium chlorate crystal.

10. *Sodii Cyanidum. Sodium Cyanide,* NaCN, U.S.P. 1910.—Obtained by (1) fusing sodium carbonate with calcium cyanide, leaching the melt with hot water, filtering, evaporating; (2) heating, metallic sodium, coal, and sodium cyanide with ammonia at above the melting-point of sodium cyanide; (3) passing hydrocyanic acid gas into alcoholic solution of sodium hydroxide, when sodium cyanide separates as a bulky crystalline precipitate. It is in white, opaque, amorphous pieces, white, granular powder, odorless (dry), deliquescent in the air, emitting odor of hydrocyanic acid (must use great caution in handling), freely soluble in cold water; aqueous solution (1 in 20) strongly alkaline, emitting odor of hydrocyanic acid; contains 95 p. c. of pure salt. Fuses at low red heat, produces intense yellow flame; aqueous solution (1 in 20) few drops, with silver nitrate T. S.—white precipitate, soluble in excess of sodium cyanide solution or ammonia water; aqueous solution 5 cc. with a few drops each of ferrous sulphate T. S. and ferric chloride T. S., + slight excess of hydrochloric acid—blue precipitate (iron ferrocyanide). *Impurities:* Ferrocyanide, sulphocyanate. Sedative, antispasmodic, anodyne; spasmodic cough, dyspnea, asthma, phthisis; action fleeting and dangerous (full dose), hence rarely employed. *Poisoning:* Similar to hydrocyanic acid and potassium cyanide; recumbent position, fresh air, iron mixture (iron sulphate, gr. 10 (.6 Gm.) + tr. ferr. chlor. ʒj (4 cc.), water ℥j (30 cc.), emetics, atropine, stimulants, demulcents. Should be kept dark in well-closed containers. Dose, gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.015 Gm.), dissolved in water.

11. *Sodii Phenolsulphonas. Sodium Phenolsulphonate,* NaC_6H_5O-$SO_3.2H_2O$, U.S.P. 1900–1910.—Obtained by mixing equal weights of phenol (crystals) and sulphuric acid, heating for 6 hours on boiling water-bath (until forming clear solution with water), adding water (10), also excess of barium carbonate, heating at 100° C. (212° F.) until acid neutralized, concentrating filtrate of barium phenolsulphonate, double decomposing with sodium carbonate, concentrating filtrate, setting aside to crystallize (1) $C_6H_5OH + H_2SO_4 = HSO_3C_6H_4OH + H_2O$; (2) $2HSO_3C_6H_4OH + BaCO_3 = Ba(SO_3C_6H_4(OH))_2 + H_2O + CO_2$; (3) $Ba(SO_3C_6H_4(OH))_2 + Na_2CO_3 = 2NaSO_3C_6H_4(OH) + BaCO_3$. It is in colorless, transparent, rhombic prisms, crystalline granules, odorless, cooling, saline, bitter taste, efflorescent, soluble in water (4.2), boiling water (.8), alcohol (140), boiling alcohol (13.5), glycerin

(5); aqueous solution (1 in 10) neutral; contains 83.64–87.82 p. c. of anhydrous sodium (para)-phenolsulphonate, corresponding to 99 p. c. of crystallized salt. Heat above 100° C. (212° F.)—loses water of crystallization, becoming white; at higher temperature—chars, emitting inflammable vapors of phenol odor, with residue of sodium sulphate; produces intensely yellow flame; aqueous solution (1 in 100) with ferric chloride T. S.—pale violet, but clear; with barium chloride T. S. original salt solution clear, but if salt ignited and residue dissolved in distilled water, + barium chloride T. S.—copious white precipitate. *Impurities:* Heavy metals, phenol. Antiferment, antiseptic, astringent; urethritis, vaginitis, otorrhea, rhinitis, fermentation, gangrene, diphtheria. Should be kept in well-closed containers. Dose, gr. 3–15 (.2–1 Gm.); mostly in injection, spray.

12. *Sodii Sulphis Exsiccatus. Exsiccated Sodium Sulphite*, Na_2SO_3, U.S.P. 1910.—Obtained by saturating a solution of sodium carbonate with sulphur dioxide, adding sodium carbonate equal to original amount taken, evaporating, crystallizing—$Na_2CO_3 + SO_2 = Na_2SO_3 + CO_2$, exposing crystals ($Na_2SO_3.7H_2O$) 100 Gm. to 100° C. (212° F.), when they lose all water of crystallization (50 p. c.) without fusing or changing shape; pulverize, sift. It is a white powder, odorless, cooling, saline, sulphurous taste; on exposure slowly oxidizes to sulphate; soluble in water (3.2), sparingly in alcohol; aqueous solution (1 in 10) alkaline; contains 90 p. c. of pure salt. At red heat—fuses to reddish-yellow mass of sodium sulphate and sulphide; produces intensely yellow flame; with hydrochloric acid—sulphur dioxide liberated, recognized by odor, and blackening strip of paper moistened with mercurous nitrate T. S. *Impurities:* Heavy metals, arsenic, thiosulphate. Antiseptic, germicide; fermentation, yeasty vomiting, aphthous sore throat, neutralizes chlorine in bleaching fabrics—rarely used in medicine. Should be kept cool, in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

13. *Sodii Pyrophosphas. Sodium Pyrophosphate*, $Na_4P_2O_7.10H_2O$, U.S.P. 1880–1900.—Obtained by heating sodium phosphate to dull redness—$2(Na_2HPO_4 + 12H_2O) = Na_4P_2O_7 + 25H_2O$. It is in colorless, transparent, monoclinic prisms, crystalline powder, odorless, cooling, saline, feebly alkaline taste, efflorescent in warm air, soluble in water (11.5), insoluble in alcohol, at 100° C. (212° F.) loses its water of crystallization (40.35 p. c.); contains in an uneffloresced condition 99 p. c. of pure salt. *Impurities:* Heavy metals, arsenic, carbonate, ortho-phosphate. Same as phosphate. Dose, ʒj–4 (4–15 Gm.).

14. *Sodii Santoninas. Sodium Santoninate*, $2NaC_{15}H_{19}O_4.7H_2O$, U.S.P. 1880.—Obtained by heating solution of sodium hydroxide 100 cc., water 30 cc., santonin 30 Gm., until dissolved, filtering, crystallizing. It is in fine felt-like crystals (prisms), inodorous, saline, bitter, alkaline reaction; soluble in water (3), alcohol (12). Anthelmintic; lumbricoid worms. Should be kept dark, in amber-colored, well-stoppered vials. Dose, adult, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr. 1–5 (.6–.3 Gm.), with sucrose (sugar).

LITHIUM.

$L^i = 6.94$.

The metal lithium (Gr. λίθος, a stone—*i. e.*, dissolves these in the system, or is found among minerals) is not official, but has several salts recognized by the *N.F.* It is found sparingly as silicate in a few rare minerals, lepidolite, spodumene, amblygonite, etc., as chloride in soils and spring water, and as carbonate in plant ashes; it is the lightest metal known, resembles potassium and sodium, and, like them, ignites when thrown upon water.

Tests for Lithium Salts: 1. The volatile salts give a vivid red to colorless flame. 2. Lithium compounds in strong solutions give with ammonium carbonate a white precipitate. 3. The neutral or alkaline solutions give with sodium phosphate, on boiling, a white precipitate (Li_3PO_4), soluble in acids and ammonium salts.

Lithii Carbonas. Lithium Carbonate, Li_2CO_3, *N.F.*—Obtained by 1, double decomposition between lithium chloride and ammonium carbonate, filtering, washing with alcohol, drying—$2LiCl + NH_4HCO_3 = Li_2CO_3 + NH_4Cl + HCl$; 2, fusing together lepidolite 10 parts, barium carbonate 10, barium sulphate 5, potassium sulphate 3. The heavy barium silicate and sulphate subside, while lithium and potassium sulphates come to the surface, the mass is now lixiviated to dissolve the two latter salts, and then by double decomposition with ammonium carbonate the lithium carbonate is obtained. It is a light, white powder, odorless, alkaline taste, permanent, soluble in water (78), boiling water (140), diluted acids with effervescence, almost insoluble in alcohol; fuses at low red heat; at higher temperature loses some carbon dioxide, becoming partially lithium oxide; saturated aqueous solution alkaline; contains 98.5 p. c. of the pure salt. Imparts crimson color to flame; mix 1 part with distilled water (20), add few drops of hydrochloric acid, with agitation until dissolved, boil, cool, render alkaline with ammonia water—no turbidity or precipitate (abs. of iron, aluminum); dissolve in 40 parts of diluted acetic acid—.15 p. c. of insoluble residue. *Impurities:* Heavy metals, iron, aluminum, other alkalies. Diuretic; to remove uric acid calculi, gout, gouty diathesis—best solvent for uric acid, renders urine alkaline, slight depressant. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), in carbonic-acid water; 1. *Sal Potassii Bromidi Effervescens Compositum,* 4.2 p. c.

Lithii Bromidum. Lithium Bromide, LiBr, *N.F.*—Obtained by heating solution of ferrous bromide with lithium carbonate, evaporating, crystallizing—$FeBr_2 + Li_2CO_3 = 2LiBr + FeCO_3$, or can dissolve lithium carbonate in hydrobromic acid. It is a white, granular salt, odorless, sharp, slightly bitter taste, very deliquescent, soluble in alcohol, ether, water (.6), boiling water (.4); aqueous solution (1 in 20)

neutral, slightly alkaline; fuses at low red heat, at higher temperature slowly volatilizes; contains 85 p. c. of the pure salt. Imparts crimson color to flame; aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or moderate excess of ammonia water; aqueous solution (1 in 20) 10 cc., + slight excess chlorine T. S., chloroform 5 cc., shake—chloroform separates, red, reddish-brown. Most hypnotic of all bromides; epilepsy, gout, etc. *Impurities:* Heavy metals, other alkalies, bromate, chloride, iodide, sulphate. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.); 1. *Elixir Bromidorum Quinque,* 3.5 p. c. 2. *Syrupus Bromidorum,* $\frac{4}{5}$ p. c.

Lithii Benzoas. Lithium Benzoate, $LiC_7H_5O_2$, *N.F.*—Obtained by adding benzoic acid to hot solution of lithium carbonate, evaporating, crystallizing—$2HC_7H_5O_2 + Li_2CO_3 +$ boiling water $= 2LiC_7H_5O_2 + H_2O + CO_2$. It is a white powder, small crystalline scales, odorless, permanent, soluble in water (3), alcohol (16), more so when solvents hot. When heated—fuses, at higher temperatures—chars, emitting inflammable vapors of benzoin-like odor, finally leaving residue of lithium carbonate and carbon, this being alkaline, effervescing with acids, and coloring non-luminous flame crimson. Aqueous solution (1 in 20) with mineral acids—voluminous white precipitate (benzoic acid); with ferric chloride T. S.—flesh-colored precipitate (ferric benzoate); contains 98.5 p. c. of pure salt. *Impurities:* Heavy metals, chlorine, other alkalies, Diuretic; gout, rheumatism, calculus disorders—no better than citrate or carbonate. Dose, gr. 5–15 (.3–1 Gm.); 1. *Elixir Hydrangeæ et Lithii,* 2.6 p. c.

Lithii Citras. Lithium Citrate, $Li_3C_6H_5O_7.4H_2O$, *N.F.*—Obtained by neutralizing a solution of citric acid with lithium carbonate, evaporating, crystallizing—$3Li_2CO_3 + 2H_3C_6H_5O_7 + H_2O +$ boiling in water $= 2Li_3C_6H_5O_7 + 4H_2O + 3CO_2$. It is a white powder, or in granular form, odorless, cooling, faintly alkaline taste, deliquescent in moist air, loses water of crystallization at 150° C. (302° F.), soluble in water (1.4), slightly in alcohol; aqueous solution (1 in 20) faintly alkaline to litmus but not reddened by 1 drop of phenolphthalein T. S.; chars at red heat, emits inflammable vapors of pungent odor, leaving black residue of lithium carbonate mixed with carbon; contains 98.5 p. c. of the pure salt. Imparts crimson color to flame; boil aqueous solution (1 in 20) with equal volume of calcium chloride T. S.—white precipitate. *Impurities:* Heavy metals, other alkalies. Diuretic, similar to the carbonate, but has more pleasant taste, is more soluble and less irritating to the stomach; is eliminated by the kidneys as such. Should be kept in air-tight containers. Dose, gr. 10–30 (.6–2 Gm.); 1. *Sal Lithii Citratis Effervescens,* 5 p. c., lith. cit. 5 Gm., sod. bicarb. 57, acid tart. 30, acid. cit. 19.5. Dose, ʒj-2 (4–8 Gm.), in water while effervescing, thus rendering it more palatable.

Lithii Salicylas. Lithium Salicylate, $LiC_7H_5O_3$, *N.F.*—Obtained by heating salicylic acid (44), lithium carbonate (12), in water (100) until effervescence ceases, filtering, evaporating—$Li_2CO_3 + 2HC_7H_5O_3 = 2LiC_7H_5O_3 + H_2O + CO_2$. It is a white, grayish-white powder, odorless, sweetish taste, deliquescent, soluble in water, alcohol, decomposed by heat, with phenol odor, leaving lithium carbonate and carbon; contains 98.5 p. c. of the pure salt. Aqueous solution (1 in 20) neutral, slightly acid, is colorless when fresh (abs. of iron, organic coloring matter), + diluted acids—does not effervesce (abs. of carbonate); with copper sulphate T. S.—bright green color. Aqueous solution (1 in 4) + few drops ferric chloride T. S.—deep red color; weaker solution (1 in 100) + ferric chloride T. S.—deep violet-blue; with hydrochloric acid—voluminous white precipitate (salicylic acid); contains 98.5 p. c. of pure salt, Antirheumatic; rheumatism, gout; superior to sodium salicylate or salicylic acid, the latter being less soluble and more irritating to the stomach. *Impurities:* Heavy metals, iron and organic coloring matter, other alkalies, carbonate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.); 1. *Elixir Hydrangeæ et Lithii,* 2.6 p. c. 2. *Elixir Manacæ Compositum,* $1\frac{3}{4}$ p. c.

AMMONIUM.

$NH^i_4 = 18.04$.

There is no metallic ammonium (L. *Ammoni-a + um*, fr. *(sal) ammoniac*, obtained from near temple of Jupiter Ammon, in Libya, by burning camel's dung)—the nearest approach to it, so far, being the ammonium amalgam or alloy made by dissolving potassium in mercury, and adding a strong solution of ammonium chloride, when potassium chloride and ammonium amalgam are formed, this latter being a soft spongy metallic substance readily decomposing into mercury, hydrogen, and ammonia gas. Although we have not the metal as represented in these elements thus joined, we nevertheless have many salts consisting of NH_4 in combination with various acids, all of which by physical and chemical properties resemble those of potassium, sodium, and lithium.

Tests for Ammonium Salts: 1. All compounds evolve ammonia gas when heated with calcium, potassium, or sodium hydroxide; the gas is recognized by odor, by restoring reddened litmus-paper, by dark-blue with cupric sulphate paper. 2. With platinic chloride + HCl get yellow precipitate. 3. Salts are white, volatile, and soluble in water. 4. In neutral solutions cobaltic nitrite gives yellow precipitate.

Ammonii Benzoas. Ammonium Benzoate, $NH_4C_7H_5O_2$, *U.S.P.*—(Syn., Ammon. Benz., Ammonium Benzoicum. Ammoniæ Benzoas, Benzoas Ammonicus; Fr. Benzoate d'Ammoniaque; Ger. Benzoësaures Ammon.)

Manufacture: Dissolve benzoic acid in 20 p. c. ammonia water by warming, stirring, keeping solution always alkaline, set aside to crystallize—$NH_4OH + HC_7H_5O_2 = NH_4C_7H_5O_2 + H_2O$. It is in thin, white, laminar crystals or crystalline powder, odorless or slight odor of benzoic acid, saline, bitter, acrid taste; loses ammonia on exposure, soluble in water (10), alcohol (35.5), glycerin (8); heated to 200° C. (392° F.) evolves ammonia and benzoic acid; ash .05 p. c.; aqueous solution neutral or slightly acid. *Tests:* Aqueous solution (1 in 10) + ferric chloride T. S.—pink precipitate. 2. Heated with potassium hydroxide T. S.—evolves ammonia; contains 98 p. c. of the pure salt. *Impurities:* Heavy metals, etc. Should be kept cool in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), best given in mixture.

Properties and Uses.—Stimulant, diuretic, alterative. Due to the benzoic acid, which is absorbed and eliminated by the kidneys as hippuric acid—the ammonia base as nitric acid; for defective action, solvent for phosphatic deposits (phosphaturia), cystitis, gouty affections, uric acid gravel, muscular rheumatism.

Incompatibles: Acids, ferric salts, solution potassium hydroxide.

Ammonii Bromidum. Ammonium Bromide, NH_4Br, *U.S.P.*—(Syn., Ammon. Brom.; Fr. Bromure d'Ammonium; Ger. Ammonium bromatum, Ammoniumbromid, Bromammonium.)

Manufacture: 1, Neutralize hydrobromic acid with ammonia water or carbonate, evaporate, crystallize—$HBr + NH_4OH = NH_4Br + H_2O$; 2, $2NH_4OH + FeBr_2 = 2NH_4Br + Fe(OH)_2$; 3, $(NH_4)_2SO_4 + 2KBr = 2NH_4Br + K_2SO_4$; this last method is the best. It is in colorless crystals, white, crystalline or granular powder; odorless, pungent, saline taste; somewhat hygroscopic, soluble in water (1.3), boiling water (.9), alcohol (12), boiling alcohol (1.2); heated volatilizes without fusing. *Tests:* 1. Aqueous solution, neutral or slightly acid, heated with potassium hydroxide T. S.—evolves ammonia. 2. With silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, or moderate excess of ammonia water. 3. Incinerate—ash .05 p. c.; contains 98.5 p. c. of the pure salt. *Impurities:* Heavy metals, iron, barium, bromate, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), ter die.

Preparations.—1. *Elixir Ammonii Bromidi, N.F.*, 8.5 p. c., ammon. brom. 8.5 Gm., syrup 20 cc., aq. dest. 46, elix. arom. q. s. 100 cc. Dose, ʒj–2 (4–8 cc.). 2. *Elixir Bromidorum Quinque, N.F.*, $1\frac{3}{4}$ p. c. 3. *Elixir Bromidorum Trium, N.F.*, 8 p. c. 4. *Syrupus Bromidorum, N.F.*, 5 p. c. 5. *Syrupus Thymi Compositus, N.F.*, 3.5 p. c.

Properties and Uses.—Sedative, hypnotic; similar to potassium bromide, but less depressing upon the arteries and muscles. Epilepsy, neurosis, delirium tremens, whooping-cough, rheumatism, menorrhagia.

Incompatibles: Acids, acid salts, spirit of ethyl nitrite.

Ammonii Chloridum. Ammonium Chloride, NH_4Cl, *U.S.P.*—(Syn., Ammon. Chlor., Muriate of Ammonia, Ammonium (Muriaticum) Hydrochloratum Depuratum, Sal (Ammoniacum) Ammoniac, Chloruretum Ammonicum; Fr. Chlorure d'Ammonium, Sel Ammoniac, Chlorhydrate d'Ammoniaque; Ger. Ammonium chloratum, Ammoniumchlorid, Reiner Salmiak, Chlorammonium.)

Manufacture: The gas-liquor, an aqueous liquid condensed in the preparation and purification of illuminating gas from coal, contains chiefly ammonium carbonate, also sulphide, cyanide, and empyreumatic products; this liquor is distilled with lime and the generated ammonia gas passed into sulphuric acid, forming ammonium sulphate, which is then sublimed with sodium chloride—$(NH_4)_2SO_4 + 2NaCl = Na_2SO_4 + 2NH_4Cl$, or the ammonia gas may be passed directly into hydrochloric acid, forming the chloride. It is a white, crystalline, granular powder, odorless, cooling saline taste, somewhat hygroscopic, soluble in water (2.6), boiling water (1.4), alcohol (100), glycerin (8); heated volatilizes without fusing; cold aqueous solution—not immediately acid; contains 99.5 p. c. of the pure salt. *Tests:* 1. Aqueous solution (1 in 10) + silver nitrate T. S.—white curdy precipitate, insoluble in nitric acid, readily soluble in ammonia water. 2. Aqueous solution heated with potassium hydroxide T. S.—evolves ammonia. *Impurities:* Heavy metals, sulphocyanate, non-volatile substances. Dose, gr. 3–20 (.2–1.3 Gm.).

Preparation.—1. *Trochisci Ammonii Chloridi.* Troches of Ammonium Chloride. (Syn., Troch. Ammon. Chlor.; Fr. Tablettes (Pastilles) de Chlorure d'Ammonium (de Sel Ammoniac); Ger. Salmiakpastillen.)

Manufacture: Triturate until thoroughly mixed ammonium chloride 10 Gm., extract of glycyrrhiza 20, tragacanth 2, sucrose 40, form mass with syrup of tolu q. s., divide into 100 troches. Dose, 1–5 troches.

Unoff. Prep.: Mistura, 2.5 p. c., + pure extract of glycyrrhiza 2.5, water q. s. 100, dose, ʒj–3 (4–12 cc.).

Properties and Uses.—Stimulant, irritant, expectorant, acute and chronic bronchitis, when mucus tough, glairy, and ropy, expectoration difficult, catarrhal pneumonia, jaundice, hepatic torpor and engorgement, glandular enlargements, hemicrania, dysmenorrhea, ovaralgia, sciatica, prostate enlargement, amenorrhea, uterine tumors, stomach hemorrhage, diabetes, rheumatism, snake-bites, contusions, tumors, ulcers, leucorrhea, gonorrhea, gangrene, chronic catarrh; in gargles, dentifrices, errhine powders; disagreeable taste may be disguised by elixir, syrup, or fluidextract of glycyrrhiza.

Incompatibles: Cardiac depressants, alkalies, alkaline earths and their carbonates, tartaric and mineral acids, soluble lead and silver salts.

Synergists: Expectorants, emetics, diaphoretics.

Ammonii Carbonas. Ammonium Carbonate, $NH_4HCO_3,NH_2NH_2CO_2$, *U.S.P.*—(Syn., Ammon. Carb., Ammoniæ Sesquicarbonas, Carbonas

Ammonicus, Volatile Salt, Sal Volatile (Siccum), Alkali Volatile; Fr. Sel volatile d'Angleterre, Alcali volatil concret, Carbonate d'Ammoniaque; Ger. Ammonium carbonicum, Ammoniumkarbonat, Kohlensaures Ammonium, Flüchtiges Laugensalz, Reines Hirschhornsalz.)

Manufacture: Heat to redness (sublime) 1 part ammonium chloride (sal ammoniac) + 2 calcium carbonate (chalk), or 4 parts each ammonium sulphate and chalk + 1 charcoal, passing vapors into leaden chambers to condense—$4NH_4Cl + 2CaCO_3 = NH_4HCO_3.NH_4NH_2CO_2 + 2CaCl_2 + NH_3 + H_2O$; the ammonia is utilized by passing it into water or dilute sulphuric acid, and ammonium sulphate is used mostly on account of cheapness. This carbonate is not normal $(NH_4)_2CO_3$, but is a double salt, one molecule being acid or ammonium bi-carbonate, and one being ammonium carbamate (carbonate deprived of H_2O); the latter dissolved in water soon becomes neutral ammonium carbonate—$NH_4NH_2CO_2 + H_2O = (NH_4)_2CO_3$. If exposed to air, gradually loses ammonia and carbon dioxide, becoming an opaque white powder of acid or ammonium bi-carbonate, NH_4HCO_3. The salt may also be obtained by washing the powdered official carbonate with a little cold water, which dissolves mainly the carbamate, leaving the bicarbonate undissolved. It is in white, hard, translucent, columnar masses, strong odor of ammonia, without empyreuma, sharp ammoniacal taste, soluble in water (4); decomposed by hot water with evolution of carbon dioxide and ammonia, completely volatilized by prolonged boiling; alcohol dissolves the carbamate, leaving the acid carbonate; on exposure loses carbon dioxide and ammonia, becoming opaque and finally friable, porous lumps or white powder; contains varying proportions of the mixed salts, and should yield 30–32 p. c. of ammonia gas. *Tests:* 1. When heated—volatilizes without charring, vapor being alkaline, and residue .05 p. c. 2. Aqueous solution (1 in 20) alkaline—effervesces with acids. *Impurities:* Heavy metals, chloride, sulphate, thiosulphate, empyreumatic substances. Should be kept cool in well-closed containers, and when for medicinal purposes, use only the translucent portions. Dose, stimulant, expectorant, gr. 2–3 (.13–.2 Gm.); for fevers, gr. 5–15 (.3–1 Gm.), in solution.

Preparations.—1. *Liquor Ammonii Acetatis.* Solution of Ammonium Acetate. (Syn., Liq. Ammon. Acet., Spirit of Mindererus; Fr. Acétate d'Ammoniaque liquide, Esprit de Mindérérus; Ger. Liquor Ammonii acetici, Ammoniumacetatlösung.)

Manufacture: Add ammonium carbonate (in hard translucent pieces, free from white, pulverulent bicarbonate) 5 Gm., gradually, to cold diluted acetic acid 100 cc., stir until dissolved. It is a clear, colorless aqueous liquid, free from empyreumatic odor, mildly saline, acidulous taste, acid reaction; volatile when heated; evaporate 20 cc., ignite residue—ash .003 Gm.; contains 6.5–7.5 p. c. of ammonium acetate, $NH_4C_2H_3O_2$, with small amounts of acetic and carbonic acids. *Tests:* 1. Heat with potassium hydroxide T. S.—ammonia evolved. 2. To 5 cc., add sulphuric acid and alcohol, each 1 cc., boil—ethyl

acetate formed, recognized by odor; must not be dispensed unless recently prepared. Dose, ʒij–4 (8–15 cc.).

Prep.: 1. *Liquor Ferri et Ammonii Acetatis*, 50 p. c.

2. *Spiritus Ammoniæ Aromaticus*, 3.4 p. c. 3. *Liquor Ferri Salicylatis, N.F.*, $\frac{65}{100}$ p. c. 4. *Magma Bismuthi, N.F.*, 1 p. c. 5. *Mistura Pectoralis*, Stokes Expectorant, *N.F.*, $1\frac{3}{4}$ p. c., ammon. carb. 1.75 Gm., fldext. seneg. 3.5 cc., fldext. scill. 3.5, tr. opii camph. 17.5, water 8.5, syr. tolu q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

Unoff. Prep.: Liquor Ammonii Citratis (Br.), $8\frac{3}{4}$ p. c., citric acid 12.5, aq. dest. q. s. 100.

Properties and Uses.—Cardiac stimulant, expectorant, rubefacient, irritant poison; pneumonia, bronchitis, phthisis, hysteria, syncope, typhus and typhoid fevers, scarlatina, measles, erysipelas, bites of venomous serpents, diabetes, headache, nervous spasms, faintness. Liquor—diuretic, diaphoretic; acute tonsillitis, bronchitis, exanthematous diseases when eruption delayed.

Incompatibles: Cardiac sedatives, acids, acid salts, lime water.

Synergists: Cardiac and diffusible stimulants, antispasmodics, capsicum; locally—cantharides, counter-irritants.

Ammonii Salicylas. Ammonium Salicylate, $NH_4C_7H_5O_3$, *U.S.P.*—(Syn., Ammon. Salicyl.; Fr. Salicylate d'Ammoniaque; Ger. Ammonium salicylicum, Ammoniumsalicylat, Salicylsaures Ammon.)

Manufacture: Dissolve salicylic acid (10) in 10 p. c. ammonia water (12), evaporate to dryness. It is in colorless, lustrous, monoclinic prisms or plates, or white, crystalline powder, odorless, saline, bitter, sweetish after-taste, permanent, soluble in water (1), alcohol (3), fuses with decomposition, emitting inflammable vapors and odor of phenol, finally volatilizes—ash .1 p. c.; contains 98 p. c. of the pure salt. *Tests:* 1. Aqueous solution (1 in 10) colorless, neutral, slightly acid; heated with potassium hydroxide T. S.—evolves ammonia; with few drops of ferric chloride T. S.—dark red, precipitate (if strong), violet-blue (if weak). 2. Concentrated aqueous solution + diluted hydrochloric or sulphuric acid—voluminous white precipitate. *Impurities:* Heavy metals, etc. Should be kept cool, dark, in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.).

Properties and Uses.—Antirheumatic, antipyretic, expectorant, germicide; febrile conditions, bronchitis, rheumatism, gout, etc.

Allied Salts:

1. *Ammonii Hypophosphis. Ammonium Hypophosphite*, $NH_4PH_2O_2$, *N.F.*—Obtained by double decomposition between solution of calcium hypophosphite and ammonium carbonate, It is in deliquescent, colorless, hexagonal plates, granular powder, odorless, saline bitter taste, soluble in water (1), alcohol (20), more so when boiling; when heated—decomposes with evolution of hydrogen phosphide (spontaneously inflammable). Aqueous solution (1 in 20) neutral, slightly acid, heated with sodium hydroxide T. S.—evolves ammonia; when slightly acidu-

lated with sulphuric acid, + silver nitrate T. S.—white precipitate, rapidly turning brown or black, due to separation of metallic silver, or heated, + copper sulphate T. S.—reddish-brown precipitate; contains 97.5 p. c. of pure salt. *Impurities:* Heavy metals, calcium salt, oxalates. Expectorant, alterative; bronchitis, laryngitis—late stages. Should be kept in well-closed containers. Dose, gr. 3–5 (.2–.3 Gm.); 1. *Syrupus Ammonii Hypophosphitis,* 3.5 p. c., ammon. hypophos. 3.5 Gm., acid. hypophos. $\frac{1}{10}$ p. c., glycerin 5, aq. dest. 10, syrup q. s. 100 cc. Dose, ℥j–2 (4–8 cc.).

2. *Ammonii Phosphas. Ammonium Phosphate* $(NH_4)_2HPO_4 + NH_4H_2PO_4$, *N.F.*—Obtained by adding strong solution of ammonia to diluted phosphoric acid until alkaline, evaporating, adding ammonia water occasionally to preserve alkalinity, drying crystals quickly. It occurs in colorless crystals, white crystalline powder, losing ammonia on exposure, soluble in water (4), insoluble in alcohol; aqueous solution (1 in 20) + magnesia mixture T. S.—white precipitate; + silver nitrate T. S.—yellow precipitate; + ammonium molybdate T. S., warming—yellow precipitate; contains in the complex not less than 22 p. c. of combined ammonia. *Impurities:* Heavy metals, calcium, aluminum, chloride, sulphate. Uric acid solvent; gout, rheumatism, diabetes. Dose, gr. 10–20 (.6–1.3 Gm.), ter die; 1. *Liquor Phosphatum Compositus,* 3.5 p. c.

3. *Ammonii Valeras. Ammonium Valerate, N.F.*—Obtained by saturating valeric acid with ammonia gas—*i. e.*, passing gas into solution of the acid until it is neutral, crystallizing. It is in colorless, white, quadrangular plates, emitting valeric acid odor, deliquescent, sharp, sweetish taste, soluble in water (.3), alcohol (.6), ether; aqueous solution (1 in 20) acid, and heated with potassium hydroxide T. S.—evolves ammonia; concentrated aqueous solution when saturated with sulphuric acid—oily layer rises to surface (valeric acid); when heated—fuses, giving off ammonia vapors and valeric acid, finally volatilizes—ash .05 p. c.; composition somewhat variable. *Impurities:* Heavy metals, acetate, Nerve sedative; hysteria, epilepsy, chorea, neuralgia, nervous headache, insomnia, heart palpitation. Should be kept in well-closed containers. Dose, gr. 2–10 (.13–.6 Gm.); 1. *Elixir Ammonii Valeratis,* 3.5 p. c., ammon. valer. 3.5 Gm., aq. ammon. to render alkaline, chloroform .15 cc., tr. vanill. 1.6, tr. persion. co. 1.6, elix. arom. q. s. 100 cc. Dose, ℥j–2 (4–8 cc.).

4. *Ammonii Iodidum. Ammonium Iodide,* NH_4I, U.S.P. 1870–1910.—Obtained by dissolving in boiling water ammonium sulphate (2), potassium iodide (2.5), stirring well, cooling, adding alcohol (1), to insure separation of potassium sulphate, evaporating filtrate to dryness, stirring constantly—$(NH_4)_2SO_4 + 2KI = 2NH_4I + K_2SO_4$. It is in minute, colorless, cubical crystals, white granular powder, odorless, sharp saline taste, very hygroscopic, on exposure soon becoming yellow, yellowish-brown, from loss of ammonia and liberation of iodine, soluble in water (.6), boiling water (.5), alcohol (3.7), glycerin (1.5); contains

99 p. c. of the pure salt. Heat strongly—evolves vapor of iodine, volatilizes without fusing, residue .1 p. c.. 2. Aqueous solution (1 in 20) neutral or slightly acid; heated with potassium hydroxide—evolves ammonia; + few drops of ferric chloride T. S.—liberates iodine, imparting violet color to chloroform when shaken with it. *Impurities:* Heavy metals, iron, barium, free iodine. Resolvent—resembles potassium iodide very much; secondary syphilis, chronic rheumatism, incipient phthisis, scrofula, enlarged tonsils, lepra, psoriasis, tinea capitis, enlarged glands. Should be kept dark, in small, well-closed containers. Dose, gr. 2–15 (.13–1 Gm.), in water, syrup; ointment (5–10 p. c.); used externally.

5. *Ammonii Nitras. Ammonium Nitrate,* NH_4NO_3.—Obtained by (1) neutralizing nitric acid with ammonia water or ammonium carbonate, filtering, evaporating—$NH_4HCO_3,NH_4NH_2CO_2 + 3HNO_3 = 3NH_4NO_3 + H_2O + 2CO_2$; (2) neutralizing gas-liquor with HNO_3 instead of HCl; (3) double decomposition between ammonium sulphate and potassium nitrate. It is in colorless, hexagonal prisms, or long, flexible, thread-like needles, or fused masses, odorless, sharp, bitter taste, soluble in water (.5), alcohol (20), deliquescent, detonates, hence should be kept in well-stoppered bottles; contains as impurities chloride, sulphate. Properties and uses very similar to those of potassium nitrate, but occasions less cardiac depression; important as the source of *nitrous oxide (gas)*, see page 682. Dose, gr. 1–20 (.06–1.3 Gm.).

6. *Ammonii Sulphas. Ammonium Sulphate,* $(NH_4)_2SO_4$, U.S.P. 1870–1880.—Obtained from coal-gas liquor by mixing it with lime, distilling off ammonia, catching it in sulphuric acid; usually contains sulphocyanate, NH_4CNS, etc.; a pure salt is prepared by neutralizing diluted sulphuric acid with ammonia water, crystallizing. It is in colorless, transparent, rhombic prisms, odorless, sharp, saline, bitterish taste, permanent, soluble in water (1.3), slightly in alcohol, decomposed by heat. *Impurities:* Iron, lead, chloride, sulphocyanate. Not used in medicine, but in the manufacture of ammonia water, ammonium chloride, ammonia alum, and sulphate of iron and ammonium.

MAGNESIUM.

Mg^{ii} 24.32.

The element magnesium (L. *magnesi(a)* + *um,* district in Thessaly; also name of two cities in Asia Minor) occupies an intermediate place between metals of the alkalies and alkaline earths, with which latter it once was classed, but now has been separated, owing to its closer recognized analogies to zinc, both having volatile chlorides, soluble sulphates, and isomorphous salts. Magnesium occurs, abundantly in nature as chloride and sulphate, in Stassfurt salt-mines, also in numerous spring waters; as carbonate in magnesite; as magnesia calcic carbonate in dolomite (magnesia lime-stone), which is so profuse in places as sometimes to form the greater bulk of mountain ranges; as

silicate in asbestos, meerschaum, serpentine, soapstone, talc, etc. The metal is obtained by the action of metallic sodium on magnesium chloride—$MgCl_2 + 2Na = 2NaCl + Mg$. It is silver-white, losing luster by oxidization; when heated to redness yields brilliant white light, and MgO; like potassium and sodium, decomposes hot water —$Mg + 2H_2O = Mg(OH)_2 + 2H$. It is not official, but several of its important salts are.

Tests for Magnesium Salts: 1. With caustic alkalies get gelatinous, white precipitates, insoluble in excess, but soluble in ammonium chloride. 2. With potassium or sodium carbonate + heat get white precipitate of basic carbonate, $4MgCO_3.Mg(OH)_2$. 3. With sodium phosphate + ammonium chloride and ammonia get white crystalline precipitate of magnesium-ammonium phosphate, $MgNH_4PO_4$. 4. Salts are white and soluble, except carbonate, phosphate, arsenate; oxide and hydroxide also are insoluble, the latter being precipitated by NaOH or KOH.

Magnesii Sulphas. Magnesium Sulphate, $MgSO_4.7H_2O$, *U.S.P.*—(Syn., Mag. Sulph., Epsom Salt, Sal Amarum—Epsomense—Anglicum or Sedlicense, Sulfas Magnesicus; Fr. Sulfate de Magnésie, Sel d'Epsom, Sel (amer) de Sedlitz; Ger. Magnesium sulfuricum, Magnesiumsulfat, Bittersalz, Schwefelsaure Magnesia.)

Manufacture: 1, Chiefly obtained from Stassfurt, as kieserite ($MgSO_4,H_2O$); heat mineral, dissolve in water, crystallize; 2, By dissolving magnesite (native $MgCO_3$) in diluted sulphuric acid, filtering, crystallizing—$MgCO_3 + H_2SO_4 = MgSO_4 + H_2O + CO_2$; 3, By heating dolomite ($MgCO_3,CaCO_3$) to dissipate CO_2, treating residue with HCl to take up calcium, and dissolving the remaining magnesium in H_2SO_4. It is in small, colorless, prismatic needles or rhombic prisms, odorless, cooling, saline, bitter taste, slowly efflorescent, soluble in water (1.3), glycerin (1.1), boiling water (.2), sparingly in alcohol; aqueous solution (1 in 20) neutral; exposed to warm air loses some water of crystallization, forming a white powder, further heating removes more water, and above 200° C. (392° F.) becomes anhydrous; contains 48.60–53.45 p. c. of anhydrous magnesium sulphate, corresponding to 99.5 p. c. of the crystallized salt. *Tests:* 1. Aqueous solution (1 in 20) with ammonium chloride T. S., ammonia water, and sodium phosphate T. S.—white, crystalline precipitate; 2, Aqueous solution with barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic, chloride. Should be kept in well-closed containers. Dose, ℥ss–1 (15–30 Gm.), in cold water or effervescing solution.

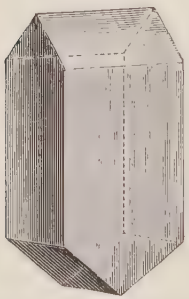


Fig. 460.—Magnesium sulphate crystal.

PREPARATIONS.—1. *Magma Magnesiæ.* Magnesia Magma, *U.S.P.* (Syn., Magma Mag., Milk of Magnesia; Fr. Lait de Magnésie; Ger. Magnesiamilch.)

Manufacture: Dissolve magnesium sulphate 30 Gm., in distilled water q. s. 65 cc., place in vessel 500 cc. capacity, heat to boiling; dissolve sodium hydroxide 10 Gm., in distilled water q. s. 100 cc., add this slowly to first boiling solution, boil for 30 minutes; transfer to cylindrical container (500 cc.), fill with hot distilled water. Allow to separate, decant supernatant liquid, wash by decantation until free from sulphates, concentrate until it contains magnesium hydroxide 7 p. c.; oil of peppermint $\frac{1}{20}$ cc. or sufficient oil of anise, or other suitable flavor may be added if desired. It is a viscous, opaque, white mixture, more or less water usually separating on standing, free from mustiness. *Tests:* 1. Add to 1 cc. diluted hydrochloric acid 2 cc.—slight effervescence (abs. of carbonate), solution slightly turbid. 2. Add ammonium chloride .5 Gm., filter, render alkaline with ammonia water—no precipitate, but upon adding sodium phosphate T. S.—white precipitate. Dose, ʒj–2 (4–8 cc.).

2. *Infusum Sennæ Compositum, N.F.*, 12 p. c. 3. *Sal Magnesii Sulphatis Effervescens, N.F.*, 50 p. c., mag. sulph. 50 Gm., sod. bicarb. 40.3, acid. tart. 21.1, acid. cit. 13.6. 4. *Salia Effervescentia, N.F.* (2).

PROPERTIES AND USES.—Cathartic, producing safe, painless, watery stools, refrigerant, diuretic; fevers, inflammatory affections, colic, constipation, dysentery, septic fever, intestinal obstruction, pleurisy, painter's (lead, barium) colic. Magma—antacid, mild laxative—valuable for children to prevent curdling of milk, and to remove intestinal curds, acute gastric catarrh, etc.

Incompatibles.: Alkaline carbonates, lime water, phosphoric acid, phosphates, lead acetate, silver nitrate.

Magnesii Carbonas. Magnesium Carbonate, $(MgCO_3)_4,Mg(OH)_2.5H_2O$, *U.S.P.*—(Syn., Mag. Carb., Carbonicas Magnesicus, Magnesia (Alba) Hydrico-carbonica; Br. Magnesii Carbonas Levis; Fr. Carbonate de Magnésie, Magnésie blanche; Ger. Magnesium carbonicum, Basisches Magnesiumkarbonat, Kohlensaure Magnesia, Weisse Magnesia.)

Manufacture: Mix strong boiling aqueous solutions of magnesium sulphate and sodium carbonate, wash precipitate to remove sodium chloride, dry without heat—$5(MgSO_4 + 7H_2O) + 5(Na_2CO_3 + 10H_2O) = [(MgCO_3)_4 + Mg(OH)_2 + 5H_2O] + 5Na_2SO_4 + CO_2 + 79H_2O$. If a heavier salt is desired (for heavy magnesium oxide), digest the salts in water and evaporate to dryness without filtering, then lixiviate the mass with water to wash out Na_2SO_4, leaving magnesium salt to be dried. It is in light, white, friable masses, bulky white powder, odorless, slight earthy taste, permanent, practically insoluble in alcohol, water, but imparts to it slight alkalinity, soluble in dilute acids with effervescence; strongly heated loses water and carbon dioxide, forming magne-

sium oxide; contains hydrated magnesium carbonate and magnesium hydroxide, corresponding to 39.2 p. c. of magnesium oxide and .8 p. c. of calcium oxide. *Tests:* 1. Dissolve in diluted hydrochloric acid, add ammonium chloride T. S., an excess of ammonia water, and sodium phosphate T. S.—white crystalline precipitate. *Impurities:* Heavy metals, iron, calcium oxide, soluble salts. Dose, antacid, gr. 5–20 (.3–1.3 Gm.); laxative, ʒss–1 (2–4 Gm.), in water, milk.

Preparations.—1. *Syrupus Tolu,* 1 p. c. 2. *Syrupus Zingiberis,* 1 p. c. 3. *Mistura Magnesiæ, Asafœtidæ et Opii,* Dewees' Carminative, *N.F.,* 5 p. c., mag. carb. 5 Gm., tr. asafœt. 7.5 cc., tr. opii 1, sucrose 10 Gm., water q. s. 100 cc. Dose, ʒj–2 (4–8 cc.). 4. *Mistura Carminativa,* Dalby's Carminative, *N.F.,* 6.5 p. c., mag. carb. 6.5 Gm., pot. carb. $\frac{3}{10}$, tr. opii 2.5 cc., oils of caraway, fennel, peppermint, āā $\frac{1}{20}$, syrup 16, water q. s. 100 cc. Dose (infant), ♏v–15 (.3–1 cc.). 5. *Elixir Eriodictyi Aromaticum, N.F.,* 1 p. c., 6. *Glyceritum Picis Pini, N.F.,* 12.5 p. c. 7. *Liquor Aromaticus Alkalinus, N.F.,* 1 p. c. 8. *Liquor Pancreatini, N.F.,* $\frac{4}{5}$ p. c. 9. *Liquor Phosphatum Acidus, N.F.,* $\frac{1}{2}$ p. c. 10. *Syrupus Eriodictyi Aromaticus, N.F.,* $\frac{1}{2}$ p. c.

Unoff. Prep.: Liquor Magnesii Bicarbonatis, Fluid Magnesia (Br.), 2 p. c.; ʒj contains gr. 10 (.6 Gm.), dose, ʒj–2 (30–60 cc.).

Properties and Uses.—Antacid, cathartic, antilithic; heartburn, dyspepsia, pregnant vomiting, nauseated stomach with acidity, excessive uric acid secretion, warts, gout; where potassium and sodium salts disagree; externally as a dusting powder in intertrigo, etc., as a cosmetic.

Magnesii Oxidum. Magnesium Oxide, MgO, *U.S.P.*—(Syn., Mag. Oxid., Magnesia, Light Magnesia, Calcined Magnesia, Light Magnesium, Magnesia Calcinata; Br. Magnesia Levis; Fr. Magnésie, Magnésie calcinée; Ger. Magnesia usta, Gebrannte Magnesia.)

Manufacture: Heat official magnesium carbonate to low redness; water and carbon dioxide escape, leaving magnesium oxide—$4(MgCO_3)$, $Mg(OH)_2$, $5H_2O$ + red heat = $5MgO + 6H_2O + 4CO_2$. It is a white very bulky, fine powder, odorless, earthy but not saline taste, on exposure slowly absorbs moisture and carbon dioxide, insoluble in alcohol, practically so in water, soluble in dilute acids; contains not more than 10 p. c. of water, and after ignition, 96 p. c. of magnesium oxide, 2 p. c. of calcium oxide. *Tests:* 1. Dissolve in diluted hydrochloric acid, add ammonium chloride T. S., an excess of ammonia water, sodium phosphate T. S.—white crystalline precipitate. *Impurities:* Heavy metals, iron, soluble salts, carbonate, water, other volatile substances. Should be kept in well-closed containers. Dose, antacid, gr. 5–20 (.3–1.3 Gm.), after meals; purgative, ʒss–1 (2–4 Gm.), added to milk or water; infants, gr. 4 (.26 Gm.).

Preparations.—1. *Ferri Hydroxidum cum Magnesii Oxido,* 1 p. c. 2. *Fluidextractum Cascaræ Sagradæ Aromaticum,* 6 p. c. 3. *Pulvis Rhei Compositus,* 65 p. c. 4. *Extractum Hydrastis, N.F.,* q. s. 5. *Massa Copaibæ, N.F.,* 6 p. c.

PROPERTIES AND USES.—Like the carbonate; antacid, laxative; dyspepsia, nauseating headache, gout, gravel, heartburn, flatulence, sour eructation, diarrhea, aphthæ, hemorrhoids, infantile colic, warts, ulcers, abrasions.

Magnesii Oxidum Ponderosum. Heavy Magnesium Oxide, MgO, *U.S.P.*—(Syn., Mag. Oxid. Pond., Heavy Magnesia, Magnesia Ponderosa, Heavy Calcined Magnesia; Fr. Magnésie Calcinée pesante; Ger. Schwere gebrannte Magnesia.)

Manufacture: Same process as magnesium oxide, except here the heavy carbonate is heated instead of the light carbonate, may triturate magnesium oxide with alcohol for some time, dry and pulverize. It is a white, dense, very fine powder; three and a half times heavier than magnesium oxide, and does not, like that, unite readily with water to form gelatinous hydroxide. Husband's Magnesia is a popular form for gastric acidity and infantile constipation. Should be kept in well-closed containers. Dose, gr. 5–40 (.3–2.6 Gm.).

PREPARATIONS.—1. *Fluidglyceratum Cascaræ Sagradæ Aromaticum, N.F.,* 2 p. c. 2. *Pulvis Rhei et Magnesiæ Anisatus, N.F.,* 65 p. c.

Liquor Magnesii Citratis. Solution of Magnesium Citrate, *U.S.P.*—(Syn., Liq. Mag. Cit.; Fr. Limonade au Citrate de Magnésie, Limonade purgative Citro-magnésienne; Ger. Magnesiumcitratlösung, Flüssige Citronensaure Magnesia.)

Manufacture: Dissolve citric acid 35 Gm. in hot water 150 cc., add magnesium carbonate 15 Gm., previously mixed with water 100 cc., stir until dissolved, add syrup 60 cc., heat to 100° C. (212° F), add immediately oil of lemon .1 cc., previously triturated with purified talc 5 Gm., filter, while hot, into a strong bottle, add boiled water q. s. 350 cc.; stopper with purified cotton until cold, drop in potassium bicarbonate 2.5 Gm., immediately stopper securely; shake bottle occasionally until dissolved; contains in each 100 cc. magnesium citrate corresponding to 1.5 Gm. of magnesium oxide. It is a slightly yellow, clear, effervescent liquid, sweet, acidulous taste, lemon flavor. *Impurities:* Calcium, citric acid, tartaric acid, sulphate. Should be kept cool, preferably in a refrigerator, with bottle on its side. Dose, for purge, 1 bottle; as a laxative, ½ bottle.

Allied Salts:

1. *Magnesii Chloridum. Magnesium Chloride,* $MgCl_2.6H_2O$, *N.F.*—Obtained by acting on magnesium carbonate with diluted hydrochloric acid, evaporating. It is in colorless, transparent crystals, white translucent pieces, deliquescent, soluble in water (.6), readily so in alcohol; aqueous solution (1 in 20) neutral; acidulated with nitric acid, + silver nitrate T. S.—white precipitate; 10 cc. + ammonium chloride T. S. 10 cc., slightly alkaline with ammonia water, + sodium phosphate T. S. –white precipitate; contains 95 p. c. of pure salt. *Impurities:* Heavy metals, arsenic, iron, calcium, barium, alcohol-insoluble

substances. Laxative, believed by some superior to citrate or sulphate, but questionable. Dose, ʒij–6 (8–24 Gm.); 1. *Liquor Hydrastinæ Compositus*, $\frac{3}{10}$ p. c.

2. *Magnesii Sulphas Effervescens. Effervescent Magnesium Sulphate*, U.S.P. 1900.—Obtained by heating slowly magnesium sulphate, crystals, 50 Gm. until it ceases to lose weight, pulverizing, mixing with citric acid 13.6 Gm., tartaric acid 21.1 Gm., sodium bicarbonate 40.3 Gm., heating in oven at 93–104° C. (199–219° F.), manipulating with wooden spatula until moist, rubbing through No. 6 tinned-iron sieve, drying granules at 54° C. (129° F.). Similar to magnesium sulphate. Should be kept in well-stoppered bottles. Dose, ʒij–8 (8–30 Gm.).

3. *Magnesii Carbonas Ponderosus. Heavy Magnesium Carbonate* (Br.).—Dissolve magnesium sulphate 125 Gm. and sodium carbonate 150 Gm., each in water 250 cc., mix solutions, evaporate to dryness, digest residue for half an hour with distilled water 500 cc., collect insoluble matter on calico filter, wash out with distilled water soluble sodium sulphate, dry. Dose, gr. 5–60 (.3–4 Gm.).

4. *Magnesii Citras Effervescens. Effervescent Magnesium Citrate.*—Obtained by mixing magnesium carbonate 10 Gm. + citric acid 30 Gm. with distilled water 4 cc., drying, powdering, mixing with sucrose 8 Gm., sodium bicarbonate 34 Gm., citric acid 16 Gm., moistening with alcohol, rubbing through No. 6 tinned-iron sieve. It is a white, coarsely granular salt, odorless, mild acid, refreshing taste, deliquescent, soluble with effervescence in 2 parts water, insoluble in alcohol. *Impurities:* Tartrate, etc. Should be kept in well-closed vessels. Similar to liquor magnesii citratis, being more portable but not so pleasant. Dose, ʒj–3 (4–12 Gm.).

CALCIUM.

$Ca^{ii} = 40.7.$

The element calcium (L. *calx, calcis*, limestone, Gr. χάλιξ) is one of a group of three—calcium, barium, strontium—which form the alkaline earths. These metals, like the alkalies and magnesium, decompose water, liberating hydrogen; metallic calcium is light, yellow, ductile like gold, malleable; seldom met with except as the native salts, which are very abundant. The carbonate occurs in calc-spar, chalk, limestone, marble, shells of eggs, mollusca, etc.; acid carbonate in water; sulphate in alabaster, gypsum, bones; phosphate in apatite, animal bone, etc.; fluoride in fluorspar; chloride in water; silicate in rocks of various kinds.

Tests for Calcium Salts: 1. With soluble salts the alkaline carbonates give white precipitates, insoluble in excess. 2. With ammonium or potassium oxalate get a white precipitate, insoluble in acetic but soluble in hydrochloric acid. 3. With sulphuric acid or KOH or NaOH get white precipitates in strong calcium solutions, but not in diluted solutions. 4. Give reddish-yellow color to flame.

Calx. Lime, CaO, *U.S.P.*—(Syn., Calcium Oxide, Quicklime, Burned Lime, Calcaria, Calx Viva, Calx Usta, Oxydum Calcicum, Calcium Oxide; Fr. Chaux (vive); Ger. Calcaria usta, Gebrannter Kalk, Ätzkalk, Kalk.)

Manufacture: By calcining white marble or the purest varieties of native calcium carbonate—$CaCO_3$ + heat = $CaO + CO_2$. It is in hard, white, grayish-white masses, granules, or white powder, odorless, caustic taste, soluble in water (840), boiling water (1740), glycerin, syrup, insoluble in alcohol; moistened with water becomes heated and gradually converted into a white powder (calcium hydroxide, slaked lime), which mixed with water (3–4) forms smooth magma (milk of lime); agitated with water—alkaline; contains 95 p. c. of the oxide, and on ignition loses not more than 10 p. c. *Tests:* 1. Mix 5 Gm., after slaking, with distilled water 100 cc., + few drops of hydrochloric acid, agitate until dissolved, boil, cool—should be acid, and not more than .05 Gm. of insoluble matter should deposit. 2. Neutralize a portion of this solution with ammonia T. S., + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid; evaporate filtrate, ignite—residue .004 Gm. (abs. of magnesia, alkali earths, alkalies). *Impurities:* Magnesia, alkali earths, alkalies, carbonate, volatile substances. Should be kept dry, in air-tight containers.

Preparations.—1. *Liquor Calcii Hydroxidi.* Solution of Calcium Hydroxide. (Syn., Liq. Calc. Hydrox., Liquor Calcis U.S.P. 1910, Liq. Calc., Lime Water, Aqua Calcis, Solution of Lime, Calcaria Solutum; Fr. Eau (Liqueur) de Chaux; Ger. Aqua Calcariæ, Kalkwasser.)

Manufacture: This aqueous solution (saturated) is prepared by slaking lime 25 Gm. with warm water 50 cc.; add water 950, agitate occasionally during 30 minutes, allow to settle, decant, reject clear liquid; to residue add water q. s. 4000 cc., agitate thoroughly. Keep in well-filled, tightly-stoppered bottle. Decant and dispense the clear liquid. The undissolved portion should not be used for making quantities unless the solution so prepared is found to be full-strength when assayed. It is a clear, colorless, odorless liquid; alkaline taste, strongly alkaline to litmus; contains .14–.17 p. c. of calcium hydroxide—stronger when cold. *Tests:* 1. Absorbs carbon dioxide from the air, forming on its surface a film of calcium carbonate. 2. Heat produces turbidity, due to separation of calcium hydroxide, which redissolves on cooling. *Impurities:* Alkalies, alkali carbonates. Dose, ℥ss–4 (15–120 cc.).

Preps.: 1. *Linimentum Calcis.* Lime Liniment. (Syn., Lin. Calc., Carron Oil; Fr. Liniment (Savon) calcaire; Ger. Kalkliniment.) *Manufacture:* 50 p. c. Mix by agitation solution of calcium hydroxide and linseed oil, each 50 cc.; used externally.

2. *Lotio Calaminæ, N.F.,* 95 p. c. (vol.). 3. *Lotio Flava, N.F.,* 95 p. c. (vol.). 4. *Lotio Nigra, N.F.,* 98 p. c. (vol.). 5. *Pasta Zinci Mollis; N.F.,* 22.5 p. c .

2. *Liquor Calcis Sulphuratæ*, Vleminckx' Solution (Lotion), *N.F.*, 16.5 p. c., + sulphur sublim., 25, water q. s. 100.

Unoff. Preps.: Liquor Calcis Saccharatus (Br.), calcium hydroxide 5 p. c., sucrose 10, water q. s. 100, ℥xv–60 (1–4 cc.). *Syrupus Calcis*, U.S.P. 1880–1900, lime 6.5 p. c., sucrose 35, water q. s. 100, ℥xv–60 (1–4 cc.).

Properties and Uses.—Lime—escharotic, depilatory, antacid, disinfectant, arrests putrefaction, hence added to stools of dysentery, cholera, typhoid fever, cesspools, sewers, ulcers, favus, psoriasis; Liquor—astringent, antacid; diarrhea, diabetes, gravel, dyspepsia, scabies, tinea capitis, ulceration of bladder, urethra, mucous and purulent discharges, ascarides of the rectum, chronic bronchitis, vomiting, nausea, prevents milk curdling in stomach, aphthæ (thrush), typhoid fever, phthisis, rachitis, cutaneous eruptions, antidote to arsenic trioxide; Liniment—burns, scalded throat—add to lint or cotton, renew frequently to prevent adhering to burned surface, etc.; Syrup—acute rheumatism, infantile diarrhea, vomiting, urinary affections.

Calx Chlorinata. Chlorinated Lime, *U.S.P.*—(Syn., Calx Chlorin., Chloride of Lime (misnomer), Calx Chlorata, Calcium Hypochlorite, Bleaching Powder, Oxymuriate of Lime, Chloris Calcicus, Chloruretum Calcis, Calcis Chloridum, Calcii Hypochloris; Fr. Chlorure de Chaux, Poudre de Tennant ou de Knox; Ger. Calcaria chlorata, Chlorkalk, Bleichkalk.)

Manufacture: Powdered slaked lime is spread upon shelves arranged in boxes or chambers into which from the top chlorine gas is passed as long as it is absorbed, at a temperature not above 25° C. (77° F.), to avoid formation of calcium chlorate—$2Ca(OH)_2 + 4Cl = Ca(ClO)_2 + CaCl_2 + 2H_2O$. It is a white, or grayish-white, granular powder, odor of chlorine, becomes moist and gradually decomposed on exposure, when it should not be used or dispensed, partly soluble in water, alcohol, the insoluble portion settling readily when mixed with water, lumps readily break down; contains 30 p. c. of available chlorine. *Tests:* 1. Shake 1 Gm. with distilled water (50)—filtrate colors red litmus blue then bleaches it. 2. Dissolve in diluted acetic acid—evolves abundance of chlorine, slight residue remains undissolved; add to this solution ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. Should be kept cool, dry, in air-tight containers. Dose, gr. 1–5 (.06–.3 Gm.), in solution; mouth wash (1 p. c.); lotion (3–5 p. c.); ointment (10 p. c.).

Preparations.—1. *Liquor Sodæ Chlorinatæ.* Solution of Chlorinated Soda. (Syn., Liq. Sod. Chlorinat., Labarraque's Solution, Liquor Sodæ Chloratæ, Liquor Natri (Chlorati) Hypochlorosi, Bleaching Solution; Fr. Chlorure de Soude liquide, Liqueur de Labarraque; Ger. Bleichflüssigkeit, Chlornatronlösung.)

Manufacture: Triturate, until uniform, chlorinated lime 10 Gm. with water 50 cc., gradually added; dissolve monohydrated sodium carbonate 7 Gm. in warm water 50 cc., add this to preceding mixture, stir or shake thoroughly, and if gelatinous warm gently until liquefied, transfer to wetted muslin strainer, return liquid until clear; add to 10 cc. a few drops of sodium carbonate T. S., if it remains clear, wash precipitate with water q. s. 100 Gm.; if cloudy—add monohydrated sodium carbonate q. s. to further precipitate and clarify; by double decomposition calcium carbonate is precipitated, while chlorinated soda and sodium chloride remain in solution—$2Na_2CO_3 + Ca(ClO)_2$,-$CaCl_2 = 2(NaClO,NaCl) + 2CaCO_3$; hot water is used to render the precipitate, $CaCO_3$, compact, as direct heat carelessly applied might decompose solution into chloride and chlorate with evolution of oxygen. It is a clear, pale greenish, aqueous liquid (solution), faint chlorine odor, disagreeable, alkaline taste, at first colors red litmus paper blue, then bleaches it; hydrochloric acid causes evolution of chlorine and carbon dioxide; contains chlorine compounds of sodium, containing not less than 2.6 p. c. NaOCl, equivalent to not less than 2.5 p. c. of available chlorine. Should be kept cool, dark, in well-stoppered bottles. Dose, ♏xxx–40 (2–2.6 cc.), in water, or some mild liquid; as a gargle or injection should be diluted 8–10 times with water.

2. *Liquor Sodæ Chlorinatæ Chirurgicalis.* Surgical Solution of Chlorinated Soda. (Syn., Liq. Sod. Chlorinat. Chir., Modified Dakin's Solution.)

Manufacture: Assay chlorinated lime, triturate necessary amount, determined by assay, with water 400 cc., gradually added until mixture uniform. Dissolve required amount (as shown by U.S.P. table) of exsiccated sodium phosphate, recently dried, in water 400 cc., at 50° C. (122° F.), add this to chlorinated lime mixture, shake, let stand 15 minutes; transfer to filter, return first portions until clear, wash residue with water q. s. for filtrate to measure 900 cc.; assay and adjust so that 100 cc. shall contain .48 Gm. of sodium hypochlorite (NaOCl). It is a colorless, faintly yellow liquid, slight chlorine odor; contains .45–.50 p. c. sodium hypochlorite, equivalent to .43–.48 p. c. available chlorine. *Test:* 1. 20 cc. + .02 powdered phenolphthalein—no red color on agitation (lim. of alkalinity). 2. 5 cc. + .5 cc. phenolphthalein T. S.—red flash (momentary—minimum alkalinity). Should be kept cool, dark, in well-stoppered bottles, and preferably for not more than 7 days.

Unoff. Prep.: Liquor Calcis Chlorinatæ (Br.), 10 p. c. + water q. s. 100 (yields 3 p. c. available chlorine).

Properties and Uses.—Desiccant, disinfectant (one of the very best), deodorizer; ulcers, chilblains, burns, skin affections, itch, putrid sore throat, ulcerated gums, dysentery, typhus fever, scrofulous enlargements, ophthalmia, aphthæ, cancers, foul breath, mercurial salivation, antidote to hydrocyanic acid and hydrosulphuric acid. Liquor Sodæ Chlorinatæ—stimulant, antiseptic, resolvent, disinfectant,

germicide; to dissolve bacteria, to liquefy sputum, so as to recognize *Tubercle bacilli*, etc., bleaching, disinfecting instruments, sick-chambers, etc.; typhus fever, scarlatina, dysentery, scrofula, carbuncles, ozena, tinea capitis, scabies, herpes, smallpox, sore nipples, etc. Liquor Sodæ Chlorinatæ Chirurgicalis—antibacterial, germicide, ranking with corrosive sublimate; to dissolve necrotic tissue in wounds, abscesses, ulcers; in irrigation must protect surrounding skin; may use full, or one-fourth, strength, gargle, lotion.

Calcii Chloridum. Calcium Chloride, $CaCl_2.2H_2O$, *U.S.P.*—(Syn., Calc. Chlor., Chloridum Calcium, Calcium Chloratum, Calcaria (Muriatica) Hydrochlorata; Fr. Chlorure de Calcium, Hydrochlorate de Chaux; Ger. Calciumchlorid, Chlorcalcium, Salzsaures Kalk.)

Manufacture: In the crude state this is a by-product in several chemical processes, especially that for ammonia water; it may be obtained pure by neutralizing hydrochloric acid with marble or other calcium carbonate, digesting the solution with chlorinated lime and slaked lime (to precipitate iron), neutralizing filtrate with hydrochloric acid, evaporating and fusing residue at 200° C. (392° F.)—$CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$. It is in white, slightly translucent, hard fragments, granules, odorless, sharp, saline taste, very deliquescent, soluble in water (1.2), boiling water (.7), alcohol (10), boiling alcohol (2); aqueous solution (1 in 20) neutral, slightly alkaline; contains 75 p. c. of the salt. *Tests:* 1. Evaporated filtrate ignited—.004 Gm. residue (abs. of magnesium, alkalies); aqueous solution (1 in 20) + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Aqueous solution (1 in 10) + silver nitrate T. S.—white precipitate insoluble in nitric acid, soluble in ammonia water. *Impurities:* Heavy metals, iron, aluminum, alkalies, magnesium, phosphates, etc. Should be kept in well-stoppered bottles. Dose, gr. 10–20 (.6–1.3 Gm.), in water, milk.

Properties and Uses.—Irritant—excessive doses occasion gastrointestinal inflammation; Resolvent—glandular enlargements, scrofulous swellings, skin diseases, lupus, uterine and ovarian tumors, fibroids.

Calcii Carbonas Præcipitatus. Precipitated Calcium Carbonate, $CaCO_3$, *U.S.P.*—(Syn., Calc. Carb. Præc., Precipitated Chalk, Creta Præcipitata, Carbonas Calcicus Præcipitatus; Fr. Carbonate de Chaux précipité, Craie précipitée; Ger. Calcium carbonicum præcipitatum, Gefälltes Kalziumkarbonat, Präcipitirter kohlensaurer Kalk.)

Manufacture: By double decomposition—adding to a hot solution of calcium chloride, while stirring, a solution of ammonium carbonate in excess, washing, drying precipitate, or may use sodium carbonate in place of ammonium carbonate—$CaCl_2 + Na_2CO_3 = CaCO_3 + 2NaCl$. It is a fine, white, microcrystalline powder, odorless, tasteless, permanent, soluble with effervescence in diluted acetic, hydrochloric, or nitric acid, practically insoluble in water, solubility increased by pres-

ence of ammonium salts, carbon dioxide, diminished by alkali hydroxides, insoluble in alcohol; heated to redness, 825° C. (1517° F.), loses carbon dioxide—residue (calcium oxide); contains 98 p. c. of the salt. *Tests:* 1. Dissolve 2 Gm. in distilled water (100), using a few drops of hydrochloric acid, boil, cool—should be acid, should not give green or crimson flame, nor respond to heavy metals, and filtrate ignited—not more than .004 Gm. of insoluble matter should remain. 2. Neutralize a portion of this acid solution with ammonia water, + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. *Impurities:* Heavy metals, magnesium, alkalies.

PREPARATIONS.—1. *Dentifricium, N.F.,* 40 p. c. 2. *Elixir Calcii Lactophosphatis, N.F.,* 1 p. c. 3. *Liquor Alumini Subacetatis, N.F.,* 7 p. c. 4. *Liquor Phosphatum Acidus, N.F.,* 5 p. c., + mag. carb. ½, acid. phos. 12, aq. dest. q. s. 100. Dose, ʒj–2 (4–8 cc.). 5. *Liquor Phosphatum Compositus, N.F.,* 7 p. c. 6. *Pasta Zinci Mollis, N.F.,* 25 p. c. 7. *Syrupus Calcii Iodidi, N.F.,* 3.4 p. c., + iodine 7.6, iron wire 2.8, sucrose 70, syrup, aq. dest., āā q. s. Dose, ʒss–1 (2–4 cc.). 8. *Syrupus Calcii Lactophosphatis, N.F.,* 2.5 p. c. 9. *Unguentum Sulphuris Compositum, N.F.,* 10 p. c.

PROPERTIES AND USES.—Similar to Creta Præparata, page 763.

Calcii Glycerophosphas. Calcium Glycerophosphate, $C_3H_5(OH)_2PO_4Ca$, *U.S.P.*—(Syn., Calc. Glycerophos., Calcium glycerinophosphate; Fr. Glycerino-phosphate de Chaux; Ger. Calcium glycerino-phosphoricum.)

Manufacture: Neutralize solution of glycerophosphoric acid with milk of lime or calcium carbonate, filter off calcium phosphate, concentrate filtrate in vacuum, precipitate with alcohol. It is a fine white powder, odorless, almost tasteless, somewhat hygroscopic, soluble in water (50), more soluble in cold water and in the presence of citric acid, insoluble in alcohol; saturated aqueous solution alkaline; this normal form contains 98 p. c. of the salt. *Tests:* 1. Cold, saturated aqueous solution heated to boiling—white, iridescent scales (anhydrous calcium glycerophosphate); decomposes at 170° C. (338° F.), evolving inflammable vapors, at red heat converted into calcium pyrophosphate. 2. Saturated aqueous solution + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid; + lead acetate T. S.—white curdy precipitate, insoluble in nitric acid. *Impurities:* Heavy metals, chloride, phosphates, sulphate, water, alcohol-soluble substances. Should be kept in well-closed containers. Dose, gr. 5–10 (.3–.6 Gm.), in powder, water, capsule, tablet, suspended in water or syrup, or dissolved in little citric or diluted hydrochloric acid, or wine.

PREPARATIONS.—1. *Elixir Calcii et Sodii Glycerophosphatum, N.F.,* .875 p. c. 2. *Elixir Glycerophosphatum Compositum, N.F.,* 1.6 p. c. 3. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.,* .875 p. c.

PROPERTIES AND USES.—Nervine, tonic, where calcium and phosphate are required; phosphorus of lecithin of food is converted into

glycerophosphoric acid before assimilation—the most natural form for administering phosphorus. Rachitis, neurasthenia, scrofula, difficult dentition, wasting diseases, convalescence, sciatica, incontinence of urine, diabetes.

Creta Præparata. Prepared Chalk, $CaCO_3$, *U.S.P.*—(Syn., Cret. Præp., Drop Chalk, Creta Lævigata; Fr. Craie préparée, Craie Lavée; Ger. Präparirte Kreide, Schlämmkreide.)

Manufacture: Chalk is a very abundant mineral, occurring largely on the coast of the English Channel and consisting of infinitesimal shells of foraminifera composed mostly of calcium carbonate, but having more or less silica, aluminum, iron, magnesium and organic matter. Our official prepared chalk is this native friable $CaCO_3$, freed from most of these impurities by elutriation, which consists in washing finely powdered chalk or whiting (the latter being the deposit from the first washings of water) with cold water, allowing the coarser particles to subside, decanting the milky liquid on suitable straining cloths, collecting the moist residue and forming same into small nodules by dropping soft mass from a funnel-shaped vessel onto a drying-tray, or may be molded into crayon-sticks, and in either shape left white or tinted with various coloring substances. It is a white, grayish-white, very fine, amorphous powder, "conical drops," odorless, tasteless, permanent, almost insoluble in water, alcohol, decomposed and dissolved by diluted acetic, hydrochloric, or nitric acid, with copious effervescence; dissolved in diluted hydrochloric acid—residue not more than 2 p. c.; contains 97 p. c. of the salt. *Tests:* 1. Dissolve .1 Gm. in diluted acetic acid 5 cc., add to filtrate ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Heat to redness—loses gradually carbon dioxide, yielding calcium oxide; gypsum sometimes sold for it.

Preparations.—1. *Pulvis Cretæ Compositus.* Compound Chalk Powder. (Syn., Pulv. Cret. Co.; Fr. Poudre de Craie composée; Ger. Kreidepulver mit Gummi.)

Manufacture: Mix thoroughly prepared chalk 30 Gm., acacia 20, sucrose 50. Dose, gr. 5–60 (.3–4 Gm.).

Prep.: 1. *Mistura Cretæ.* Chalk Mixture. (Syn., Mist. Cret.; Fr. Mixture avec la Craie; Ger. Kreidemixtur.)

Manufacture: Triturate prepared chalk 6 Gm. with glycerin 10 cc., added slowly, until smooth, add cinnamon water 40 cc., distilled water q. s. 100 cc. Should be recently prepared. Dose, ʒj–4 (4–15 cc.).

2. *Hydrargyrum cum Creta,* 57 p. c., + mercury 38 p. c. 3. *Dentifricium, N.F.,* 40 p. c. 4. *Pulvis Cretæ Aromaticus, N.F.,* 25 p. c., + cinnamon 8, myristica 6, clove 3, cardamom seed 2, sucrose 56. Dose, gr. 15–60 (1–4 Gm.). 5. *Pulvis Cretæ et Opii Aromaticus, N.F.,* pulv. cret. arom. 97.5 Gm., opium 2.5. Dose, gr. 10–60 (.6–4 Gm.).

PROPERTIES AND USES.—Mainly in tooth powders, etc.; the precipitated is considered best for such preparations, as it is finer and contains no grit; the prepared is preferable for chalk mixtures, face and toilet powders, from its more adhesive properties, dusting powder to ulcers, burns, abrasions; antidote to oxalic acid poisoning; the troches, U. S. P. 1820–1890, used as a mild astringent, antacid in diarrhea, gastric acidity (preceded by a purge), being well adapted for children; the mixture for diarrhea, loose bowels of infants, etc.

Incompatibles: Acids and sulphates.

Calcii Bromidum. Calcium Bromide, $CaBr_2.2H_2O$, *U.S.P.*—(Syn., Calc. Brom.; Fr. Bromure de (Chaux) Calcium; Ger. Bromcalcium, Calcium (bromid) bromatum).

Manufacture: Dissolve pure calcium carbonate in hydrobromic acid, filter, evaporate to dryness—$CaCO_3 + 2HBr = CaBr_2 + H_2O + CO_2$; or by boiling milk of lime with ammonium bromide. It is a white granular salt, odorless, sharp, saline taste, very deliquescent, soluble in water (.7), boiling water (.4), alcohol (1.3), insoluble in chloroform, ether; aqueous solution (1 in 20) neutral, slightly alkaline; this hydrated form contains 84 p. c. of the salt. *Tests:* 1. Aqueous solution (1 in 20) + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. 2. Aqueous solution (1 in 10) + silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, slightly soluble in excess of ammonia water. *Impurities:* Heavy metals, iron, alkalies, barium, magnesium, bromate, chloride, iodide, sulphate. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.), in water.

PREPARATIONS.—1. *Elixir Bromidorum Quinque, N.F.*, $5\frac{1}{4}$ p. c. 2. *Syrupus Bromidorum, N.F.*, 2.5 p. c.

PROPERTIES AND USES.—As a substitute for potassium bromide; hypnotic, sedative, in insomnia, hysteria, epilepsy; depresses heart less than potassium bromide.

Calcii Lactas. Calcium Lactate, $Ca(C_3H_5O_3)_2.5H_2O$, *U.S.P.*—(Syn., Calc. Lact.; Fr. Lactate de chaux purifié; Ger. Kalziumlaktat, Milchsaurer Kalk.)

Manufacture: Neutralize hot dilute solution of lactic acid with calcium carbonate, filter, set aside to crystallize: also largely an intermediate product in preparing lactic acid. It is in white, granular masses or powder, odorless or nearly so, nearly tasteless, somewhat efflorescent, anhydrous at 120° C. (248° F.), losing 25–30 p. c., corresponding to 5 molecules of water of crystallization, soluble in water (20), practically insoluble in alcohol; aqueous solution (1 in 20) neutral, slightly acid or alkaline; this hydrated form contains 98 p. c. of the hydrated salt. *Tests:* 1. Acidulate aqueous solution (1 in 20) with sulphuric acid, + potassium permanganate, heat—odor of acetaldehyde. 2. Aqueous solution + ammonium oxalate T. S.—white precipitate,

insoluble in acetic acid, soluble in hydrochloric acid. Should be kept in well-closed containers. Dose, gr. 3–10 (.2–.6 Gm.).

PREPARATIONS.—1. *Elixir Calcii Lactophosphatis, N.F.*, calc. carb. præc. 1 p. c., acid. lact. 3, acid. phos. 1.5, sp. aurant. co. 1, syrup 35, alcohol 20, aq. dest. q. s. 100. 2. *Syrupus Calcii Lactophosphatis, N.F.*, calc. carb. præc. 2.5 p. c., acid. lact. 6, acid phos. 3.6, aq. aurant. flor. 5, sucrose 65, glycerin 5, aq. dest. q. s. 100. 3. *Syrupus Calcii Lactophosphatis et Ferri, N.F.*, ferr. lact. .85 p. c., pot. cit. .85, water $6\frac{1}{4}$, syr. calc. lactophos. q. s. 100. Dose, each, ʒj–2 (4–8 cc.).

PROPERTIES AND USES.—Contains calcium in an absorbable form, and usually is combined with calcium carbonate, phosphate, or iron lactate; substitute for calcium chloride. Rachitis, scrofula, etc.; syrup of calcium lactophosphate; most palatable form—also thought to increase the coagulability of the blood.

Calcii Iodobehenas. Calcium Iodobehenate, $[(C_{21}H_{42}ICOO)_2Ca]$, *U.S.P.* —(Syn., Calc. Iodobehen., Calioben, Calcium Moniodobehenate.)

Manufacture: Neutralize monoiodobehenic acid with calcium carbonate, collect and wash precipitate—$2HC_{22}H_{42}IO_2 + CaCO_3 = Ca(C_{22}H_{42}IO_2)_2 + H_2O + CO_2$. It is a white, yellowish, unctuous powder; odorless, or slightly fat-like; tasteless; insoluble in water, very slightly soluble in alcohol, ether, freely soluble in warm chloroform; heated strongly, is decomposed with evolution of violet vapors (iodine) and white vapors having odor of burning fat; dried to constant weight loses 2 p. c. water and contains not less than 23.5 p. c. of iodine. *Tests:* 1. Heat .2 Gm. with sulphuric acid 2 cc. on water-bath, 5–10 minutes, cool, add chloroform 2 cc., shake gently—chloroform layer violet (iodine). 2. Dissolve 1 Gm. in warm chloroform 10 cc.—only slight opalescence. *Impurities:* Magnesium, alkali salts, soluble salts, carbonate, water. Should be kept dark, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

PROPERTIES AND USES.—Alterative, resolvent, substitute for inorganic iodides in persistent chronic conditions (arthritis, asthma, bronchitis), where it gives a slower, more constant and higher iodine percentage to the blood with less gastric disturbance and tendency toward iodism; where rapid action is needed inorganic iodides are preferable.

Allied Salts:

1. *Calcii Hypophosphis. Calcium Hypophosphite,* $Ca(PH_2O_2)_2$, *N.F.*—Obtained by heating in a deep vessel milk of lime and phosphorus, when latter dissolved filter, evaporate filtrate to dryness on water-bath, or allow to crystallize—$3Ca(OH)_2 + 8P + 6H_2O = 3Ca(PH_2O_2)_2 + 2PH_3$ (inflammable phosphine). It is in colorless, transparent, monoclinic prisms, small lustrous scales, or white crystalline powder, odorless, nauseous, bitter taste, permanent, soluble in water (6.5), insoluble in alcohol, when heated decrepitates and decomposes, giving off water and inflammable phosphine (hydrogen phosphide), and on complete ignition leaves residue (calcium pyrophospate); contains 98 p. c. of

the salt. Aqueous solution (1 in 20) acidulated with a few drops of hydrochloric acid, with agitation, + mercuric chloride T. S.—white precipitate (mercurous chloride), becoming gray (reduced to metallic mercury) upon the further addition of aqueous solution. 2. Aqueous solution + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. *Impurities:* Heavy metals, arsenic, phosphate. Stimulant to nervous system; phthisis, scrofula, caries, chlorosis, menorrhagia, rickets, fractures, Pott's disease; converted in stomach into phosphate, absorbed as lactophosphate—the base of other hypophosphites. Should be kept in well-closed containers, and dispensed with caution, as an explosion is liable to occur when triturated or heated with nitrates, chlorates, or other oxidizing agents. Dose, gr. 5–30 (.3–2 Gm.); 1. *Syrupus Calcii Hypophosphitis*, 3.5 p. c., + acid. hypophos. $\frac{15}{100}$, sucrose 77.5, aq. dest. q. s. 100. 2. *Syrupus Calcii et Sodii Hypophosphitum*, 3.5 p. c., + sod. hypophos. 3.5, acid. hypophos. $\frac{15}{100}$, glycerin 5, sucrose 75, aq. dest. q. s. 100. 3. *Syrupus Hypophosphitum*, 4.5 p. c., + pot. hypophos., sod. hypophos., āā 1.5, acid. hypophos. $\frac{1}{10}$, glycerin 5, sucrose 60, aq. dest. q. s. 100. 4. *Syrupus Hypophosphitum Compositus*, 3.5 p. c., + pot. hypophos. $1\frac{3}{4}$, sod. hypophos. $1\frac{3}{4}$, ferr. hypophos. .225, mangan. hypophos. .225, quinine .11, strychnine .0115, sod. cit. .375, acid. hypophos. $\frac{1}{2}$, sucrose 70, glycerin 5, water q. s. 100. Dose, each, ℥j–2 (4–8 cc.). 5. *Emulsum Olei Morrhuæ cum Hypophosphitibus*, 1 p. c. 6. *Liquor Hypophosphitum Compositus*, .85 p. c., + pot. hypophos. .85, ferr. hypophos. .44, sod. hypophos., mangan. hypophos., āā .22, quinine, .2, strychnine .0065, pot. cit. .85, acid. hypophos. $\frac{7}{10}$, aq. aurant. flor. 3.5, glycerin 35, aq. dest. q. s. 100. Dose, ℥ss–2 (2–8 cc.).

2. *Calcii Lactophosphas. Calcium Lactophosphate, N.F.*—A mixture in variable proportions of calcium lactate, calcium acid lactate, and calcium acid phosphate corresponding to 1.5–2 p. c. of P_2O_5. It is in white granules, white powder, odorless, soluble in water, nearly insoluble in alcohol, acid reaction. Aqueous solution + ammonium oxalate T. S.—white, precipitate, insoluble in acetic acid, soluble in hydrochloric acid; aqueous solution (1 in 20) 5 cc. + diluted sulphuric acid 10 cc., + potassium permanganate T. S. 5 cc., warm gently—odor of acetaldehyde evolved; similar portion + silver nitrate T. S. or ammonium molybdate T. S.—yellow precipitate. *Impurities:* Heavy metals, arsenic, magnesium, chloride, sulphate, readily carbonizable substances. Defective nutrition, tonic, alterative, more soluble than phosphate; bone troubles, rickets, scrofula, fractures. Dose, gr. 5–15 (.3–1 Gm.); 1. *Elixir Calcii Lactophosphatis*, 1 p. c. 2. *Syrupus Calcii Lactophosphatis*, 2.5 p. c.: Prep.: 1. *Syrupus Calcii Lactophosphatis et Ferri*, ferr. lact., pot. cit., āā $\frac{85}{100}$, water $6\frac{1}{4}$, syr. ca. lac. q. s. 100. Dose, each, ℥j–2 (4–8 cc.).

3. *Calcii Phosphas Præcipitatus. Precipitated Calcium Phosphate*, $(Ca_3(PO_4)_2$, *N.F.*—Obtained by dissolving bone-ash (bone calcined to whiteness in fine powder) in dilute hydrochloric acid, forming acid

calcium phosphate, and calcium chloride in solution, which is poured into dilute ammonia water in excess—$Ca_3(PO_4)_2 + 4HCl = Ca(H_2PO_4)_2 + 2CaCl_2$; $Ca(H_2PO_4)_2 + 2CaCl_2 + 4NH_4OH = Ca_3(PO_4)_2 + 4NH_4Cl + 4H_2O$; a purer salt is made thus—$2Na_2HPO_4 + 3CaCl_2 + 2NH_4OH = Ca_3(PO_4)_2 + 4NaCl + 2NH_4Cl + 2H_2O$. It is a bulky, white, amorphous or microcrystalline powder, odorless, tasteless, permanent, insoluble in alcohol, almost so in water, acetic acid; partly decomposed by boiling water as it dissolves out the acid salt, soluble in hydrochloric or nitric acid; contains 96 p. c. of pure salt. Defective nutrition, rickets (mollities ossium), scrofula, phthisis, fractures, night-sweats; in pharmacy, owing to insolubility in water, as a substitute for magnesium carbonate in making medicated waters, clarifying mixtures, etc. Dose, gr. 5–30 (.3–2 Gm.); 1. *Pulvis Antimonialis*, 67 p. c. 2. *Syrupus Phosphatum Compositus*, Chemical Food—liq. phosphatum co. 50 p. c., + syrup 33.4, glycerin 15, tr. persion. 1.6. 3. *Syrupus Phosphatum cum Quinina et Strychnina*, liq. phosphatum co. 50 p. c., quin. hydrochl. .44, strych. nit. .014, glycerin 15, syrup q. s. 100. Dose, each, ℥j–2 (4–8 cc.).

4. *Calcii Sulphas Exsiccatus. Dried Calcium Sulphate*, $CaSO_4$, U.S.P. 1890–1900.—Obtained from the purer varieties of gypsum, $CaSO_4 + 2H_2O$, by carefully heating at 105° C. (221° F.) until three-fourths of water expelled—$2\ CaSO_4.2H_2O = (CaSO_4)_2.H_2O$ (Plaster of Paris). It is a fine, white powder, odorless, tasteless, exposed to moist air absorbs water, becoming granular and losing the property of hardening with water; mixed with half-weight of water forms a smooth paste which hardens rapidly, soluble in water (378), readily in diluted nitric or hydrochloric acid, saturated solution of potassium nitrate, sodium thiosulphate, ammonium salts, insoluble in alcohol; contains 95 p. c. of pure salt, and 5 p. c. of water. Not used internally; chiefly by surgeons for mechanical purposes—casts, supports, etc., to immobilize injured or diseased parts, fractures; Pott's disease (spinal), lateral curvature, deformities of ankle- and knee-joints; fix bandages in amputation, dental surgery—oral impressions, molds for interdental splints, etc. Should be kept carefully protected from moisture, in well-closed containers.

5. *Calcis Carbonas. Carbonate of Lime.*—Formerly official under two forms, viz.: 1. *Calcis Carbonas Durus* (hard), Marmor, Marble, U.S.P. 1820 1830; also called "native white granular carbonate of lime." 2. *Calcis Carbonas Mollis* (soft), Creta, Chalk, U.S.P. 1820–1880; also called "native friable carbonate of lime."

6. *Calcii Sulphidum Crudum. Crude Calcium Sulphide*, CaS.—Obtained by heating dried calcium sulphate (70), charcoal (10), starch (2), in loosely covered crucible, to bright redness until uniform gray results—$CaSO_4 + C_3 = CaS + 2CO + CO_2$. It is a pale gray, yellowish powder, faint odor of hydrogen sulphide, nauseous, alkaline taste, gradually decomposes on exposure, soluble in solutions of ammonium salts, slightly soluble in water, more so in boiling water with partial

decomposition, insoluble in alcohol; contains 55 p. c. of the salt. *Tests:* 1. Decompose with diluted acetic acid—evolves hydrogen sulphide and sometimes sulphur dioxide, residue calcium sulphate and carbon. 2. Filtered solution, + ammonium oxalate T. S.—white precipitate, insoluble in acetic acid, soluble in hydrochloric acid. Depilatory; itch, ringworm, acne, furuncular eruptions, buboes, leucorrhea, rhinitis, diphtheria, rheumatism. Should be kept in well-closed containers. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

BARIUM.

$Ba^{ii} = 137.37.$

The element barium (L. *bar(ytes)* + *ium*, fr. Gr. *βαρύς*, heavy, owing to high sp. gr. of heavy spar) and its compounds are not much used in medicine; it is found rarely in nature, and occurs then chiefly as sulphate (barite or heavy spar, $BaSO_4$), also as carbonate (witherite, $BaCO_3$). The metal fuses with difficulty, is of a silver-gray color, decomposes water, oxidizes rapidly, sp. gr. 3.6. Salts are poisonous, but used sometimes in medicine as alterative, diuretic, cardiac tonic; cutaneous affections, scrofula; the sulphate employed to adulterate white lead, the nitrate in preparing green fire.

Tests for Barium Salts: 1. With H_2SO_4 or a soluble sulphate get white precipitate of barium sulphate, insoluble in all acids. 2. With alkaline carbonate get white precipitate, insoluble in excess. 3. With $K_2Cr_2O_7$ get pale yellow precipitate of $BaCrO_4$. 4. Gives yellowish-green color to flame.

Poisoning: Have salivation, thirst, vomiting, purging, abdominal pains, cramps, feeble pulse, dilated pupils, excessive urination, difficult breathing, spine paralysis, convulsions, collapse, death. Give emetics, magnesium or sodium sulphate (antidotes), albuminous drinks, diffusible stimulants, digitalis, opium, heat, etc.

Barii Sulphas. Barium Sulphate, $BaSO_4$, *U.S.P.*—(Syn., Sulphate of Barytes, Artificial Heavy Spar, Terra Alba (Ponderosa, Snow (Permanent) White, Barii Sulphas Roentgenographicus; Fr. Baryte Sulfate, Blanc Fixé; Ger. Bariumsulfat, Barytspath Schwefelsaurer.)

Manufacture: Although this is a native mineral (heavy spar) from which the various barium compounds are prepared, it can be made by adding sulphuric acid, or an alkaline sulphate to solution of barium sulphide, nitrate or chloride, washing well the precipitate—$BaCl_2 + H_2SO_4 = BaSO_4 + 2HCl$. It is a fine, white, odorless, tasteless, non-gritty, bulky powder, insoluble in water, organic solvents, aqueous solutions of acids and alkalies, neutral, sp. gr. 4.6. *Tests:* 1. Mix .5 Gm. with 2 Gm. each of anhydrous sodium carbonate and potassium carbonate, fuse mixture, treat mass with hot water, acidulate portion of filtrate with hydrochloric acid, add 1 cc. barium chloride T. S.—white precipitate. 2. Dissolve in acetic acid portion of well-washed

precipitate—responds to barium reactions. *Impurities:* Heavy metals, arsenic, sulphide, phosphate, acid-soluble substances, soluble barium salts. Its official title should never be abbreviated—in order to avoid possible confusion with the poisonous (soluble) barium sulphide or sulphite.

Properties and Uses.—Owing to its insolubility and opacity largely used in roentgen-ray work, being so far the best substance (bismuth salts—more expensive and larger amount required) in making roentgenograms of internal cavities, stomach, intestine, etc. Stomach examination: Give, evening before, castor oil ℥j (30 cc.), next morning wheat meal porridge having well-mixed with it barium sulphate ℥ij (60 Gm.) sweetened with sugar (sucrose) and cream—make examination 6 hours later; for colon: Inject into rectum, at elevation 3–6° (90–180 Cm.), a warm enema consisting of mucilage of acacia 16 ounces, condensed milk 3 pounds, barium sulphate 8 ounces—examine later with fluoroscope while injection is passing into rectum. Barium sulphate also used for glazing cards, in water colors, by painters instead of white lead, and as a pigment and filler in rubber goods.

Allied Salts:

1. *Barii Carbonas. Barium Carbonate*, $BaCO_3$, U.S.P. 1820, 1840–1870.—This is native *witherite*, found in lead mines in England, Scotland, Sweden. May be obtained artificially by precipitating a soluble barium salt with an alkali carbonate, or may fuse barium sulphate 10 parts, carbon 2, potassium hydroxide 5; wash the mass with water, thus leaving behind the carbonate—$BaSO_4 + C_2 + 2KOH = BaCO_3 + K_2S + CO_2 + H_2O$. It is in grayish fibrous masses or rhombic crystals, sp. gr. 4.5. If made artificially, it is a soft, white, amorphous or crystalline, tasteless powder. *Impurities:* Sulphate, lead, metals, alkalies, calcium. Other barium salts may readily be made by acting upon this salt with the respective acids; thus, nitrate—$BaCO_3 + 2HNO_3 = Ba(NO_3)_2 + H_2O + CO_2$; hydroxide—$BaCO_3 + 2KOH = Ba(OH)_2 + K_2CO_3$, also bromide, iodide, etc.

2. *Barii Chloridum. Barium Chloride*, $BaCl_2.2H_2O$, U.S.P. 1820–1870.—Obtained by dissolving barium carbonate in diluted HCl, evaporating, crystallizing $-BaCO_3 + 2HCl = BaCl_2 + H_2O + CO_2$; or (1) $BaSO_4 + C_2 +$ white heat $= BaS + 2CO_2$, (2) $BaS + 2HCl = BaCl_2 + H_2S$. While the first method, in which the native carbonate is used, is the better, that salt is so scarce that the second formula is followed generally. It is in colorless, translucent, rhomboidal tables or lamellæ, permanent, soluble in diluted alcohol or water. *Impurities:* Carbonate, sulphate, lead, metals, alkalies, calcium, strontium chloride. Used only in making *Barium Chloride* T. S. (12 Gm. + distilled water q. s. 100 cc.).

3. *Barii Dioxidum. Barium Dioxide*, BaO_2, U.S.P. 1890–1900.—Obtained by passing oxygen or air over barium oxide or hydroxide heated to redness. It is a heavy grayish or yellowish-white amorphous coarse powder, odorless, tasteless, nearly insoluble in water,

forms salts with acids, slowly decomposes, absorbing H_2O and CO_2. Used only in making *Liquor Hydrogenii Dioxidi.*

The test-solutions of the chloride, hydroxide, and nitrate are all used officially in assaying official salts, acids, etc.

STRONTIUM.

$Sr^{ii} = 87.63.$

The element strontium (L. fr. *strontium*, in Argyleshire, Scotland, where first found as *strontianite*, $SrCO_3$) in the form of its compounds was not until recent years used to any extent in medicine. It occurs natively as sulphate (*celestite*, $SrSO_4$) and carbonate. The metal itself is yellow, malleable, harder than lead, sp. gr. 2.5, oxidizes quickly when exposed, hence has to be kept under naphtha, like the alkali metals. The salts can be produced in a manner similar to those of barium, thus: Heat strontium sulphate with carbon, which gives strontium sulphide; this sulphide dissolved in HCl yields the chloride, which by double decomposition with Na_2CO_3 gives pure strontium carbonate (strontii carbonas), $SrCO_3$, 99 p. c. purity, from which the commercial salts are made.

Tests for Strontium Salts: 1. With alkaline carbonates, oxalates, or phosphates get white precipitate. 2. With calcium sulphate get white precipitate of $SrSO_4$. 3. With H_2SO_4 or a soluble sulphate get white precipitate. 4. Add potassium chromate and get yellow precipitate, $SrCrO_4$, soluble in acids; here $K_2Cr_2O_7$ gives no precipitate. 5. Gives a beautiful red color to flame.

Strontii Salicylas. Strontium Salicylate, $Sr(C_7H_5O_3)_2.2H_2O$, *U.S.P.*—(Syn., Stront. Salicyl.; Fr. Salicylate de Strontium; Ger. Strontium salicylicum (salicylsäures.)

Manufacture: Dissolve salicylic acid (10) in hot water (100), add strontium carbonate (5.34), heat until effervescence ceases, filter, evaporate to crystallization. It is a white, crystalline powder, odorless, somewhat sweet, saline taste, soluble in water (19), boiling water (3.7), alcohol (61), boiling alcohol (14); contains, when dried to constant weight, 99 p. c. of pure salt. *Tests:* 1. When heated—decomposes with inflammable vapors of phenol odor, and residue of strontium carbonate and carbon; produces intensely red flame. 2. Aqueous solution (1 in 20) colorless, with calcium sulphate T. S.—slowly a white precipitate (strontium sulphate), insoluble in dilute acids. 3. Concentrated aqueous solution with a few drops of ferric chloride T. S.—dark red color and a precipitate; with diluted hydrochloric acid —voluminous, white precipitate (salicylic acid); aqueous solution (1 in 100)—deep violet-blue color. *Impurities:* Heavy metals, barium. Should be kept cool, dark, in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

Properties and Uses.—Antirheumatic, tonic; rheumatism, gout, chorea, muscular pains, pleurisy, intestinal fermentation.

Incompatibles: Ferric salts, lime water, spirit of ethyl nitrite, mineral acids, solutions of quinine salts, lead acetate, silver nitrate, sodium phosphate.

Allied Salts:

1. *Strontii Bromidum. Strontium Bromide,* $SrBr_2.6H_2O$, U.S.P. 1890–1910.—Obtained by dissolving strontium carbonate in hydrobromic acid until neutralized, evaporating, crystallizing—$SrCO_3 + 2HBr = SrBr_2 + H_2O + CO_2$. It is in colorless, transparent, hexagonal crystals, odorless, bitter, saline taste, deliquescent (moist air), efflorescent (dry air), soluble in alcohol, water (.35), insoluble in ether; aqueous solution (1 in 20) neutral; contains 98 p. c. of pure salt. Quickly heated—melts, and above 180° C. (356° F.) loses all water of crystallization; produces intensely crimson flame. Aqueous solution (1 in 10) with silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid or moderate excess of ammonia water; aqueous solution (1 in 20) with calcium sulphate T. S—slowly a white precipitate (strontium sulphate), insoluble in dilute acids; diluted sulphuric acid or readily soluble sulphate gives quicker precipitate. *Impurities:* Heavy metals, barium, iodine, bromate. Similar to potassium bromide; epilepsy, gastric disorders, albuminuria. Should be kept in well-closed containers. Dose, gr. 10–30 (.6–2 Gm.).

2. *Strontii Iodidum. Strontium Iodide,* $SrI_2.6H_2O$, U.S.P. 1890–1910.—Obtained by dissolving strontium carbonate in hydriodic acid until neutralized, evaporating, crystallizing—$SrCO_3 + 2HI = SrI_2 + H_2O + CO_2$. It is in colorless, transparent, hexagonal plates, white, granular powder, crystalline crusts, odorless, bitter, saline taste, deliquescent and yellowish on exposure, soluble in water (.2), alcohol, slightly in ether; aqueous solution (1 in 20) neutral, slightly alkaline; contains 99 p. c. of pure salt. Cautiously heated—crystals melt and gradually lose water of crystallization; at red heat—decomposed, losing iodine with residue of strontium oxide; produces intensely crimson flame. Aqueous solution (1 in 10) with calcium sulphate T. S.—slowly a white precipitate (strontium sulphate), insoluble in dilute acids; diluted sulphuric acid or readily soluble sulphates gives quicker precipitate. Aqueous solution (1 in 20) 5 cc. with ferric chloride T. S. 1 cc.—iodine liberated, which imparts violet color to chloroform, when shaken with it. Alterative; does not irritate intestinal tract or depress nutrition; may be substituted for potassium iodide. *Impurities:* Heavy metals, barium, bromide, chloride, cyanide. Should be kept dark, in small, amber-colored, glass-stoppered bottles. Dose, gr. 10–30 (.6–2 Gm.).

3. *Strontii Lactas. Strontium Lactate,* $Sr(C_3H_5O_3)_2.3H_2O$.—Obtained by dissolving strontium carbonate in lactic acid until neutralized, evaporating, crystallizing—$SrCO_3 + 2HC_3H_5O_3 = Sr(C_3H_5O_3)_2 + H_2O + CO_2$. It is a white granular powder, or in crystalline nodules,

odorless, bitter, saline taste, permanent; soluble in water (4), also in alcohol. By heat decomposes into carbonate, which effervesces with HCl. *Impurities:* Barium, carbonate, oxalate, chloride, butyrate, propionate, arsenic, lead, iron, aluminum. *Incompatibles:* Carbonate and sulphate solutions; potassium chromate. Diuretic; nephritis, albuminuria, rheumatism, gout, causes disappearance of the urates. Dose, gr. 10–30 (.6–2 Gm.), ter die.

Some of the commercial salts, chiefly nitrate, are used for red fire.

ALUMINUM.

$Al^{iii} = 27.$

The metal aluminum (L. *alumen, alumin(is)* + *um, alum,* fr. *alo,* to nourish, as confounded with iron sulphate) is the typical representative of the earths and the only one having any medicinal use, the other members being of only scientific interest. It occurs largely in combination with silicic acid in silicated rocks, clays, forming the greater bulk of our earth—basalt, feldspar, granite, hornblend, mica, slate—clay results from decomposition of these. The valuable minerals corundum, emery, ruby, and sapphire, are crystals of aluminum oxide colored with other substances. The metal is obtained by decomposing Al_2Cl_6 with metallic sodium—$Al_2Cl_6 + 6Na = 2Al + 6NaCl$. It is a very light, silvery-white metal, sp. gr. 2.6, capable of taking a high polish; owing to these properties the metal is used extensively.

Tests for Aluminum Salts.—1. Potassium or sodium hydroxide gives white gelatinous precipitate, soluble in excess. 2. Ammonium hydroxide gives a like precipitate, but insoluble in excess. 3. Alkaline carbonates precipitate also the white hydroxide with liberation of CO_2. 4. Ammonium sulphide precipitates hydroxide, liberating H_2S. 5. Sodium phosphate precipitates aluminum phosphate, soluble in acids.

Alumen. Alum, $AlNH_4(SO_4)_2.12H_2O$ or $AlK(SO_4)_2.12H_2O$, *U.S.P.*—(Syn., Aluminii et Ammonii Sulphas, Ammonium Alum; Fr. Alun ammoniacal; Ger. Ammoniak Alaun; Aluminii et Potassii Sulphas, Potassium Alum; Fr. Sulfate d'Alumine et de Potasse; Ger. Alaun, Kali-Alaun.)

Manufacture: Decompose aluminum silicate (alum-clay) with sulphuric acid, forming aluminum sulphate, and to this in solution add either ammonium sulphate or potassium sulphate, when, on evaporation, ammonium alum or potassium alum crystallizes. Both occur in large colorless crystals, crystalline fragments, white powder; odorless; sweetish, strongly astringent taste; ammonium alum soluble in water (5.2), hot water (.3), and when strongly heated ammonium sulphate volatilizes; aqueous solution (1 in 20) + sodium hydroxide T. S.—precipitate, soluble in excess, ammonia being evolved; incinerate—ash .5 p. c.; potassium alum is soluble in water (7.2), boiling water

(.3), freely in glycerin, insoluble in alcohol; gives violet flame; saturated solution 5 cc. + sodium bitartrate T. S. 10 cc.—white crystalline precipitate within 30 minutes; aqueous solution (1 in 20) + sodium hydroxide T. S.—precipitate, soluble in excess, but no ammonia evolved. *Tests:* 1. Aqueous solutions (1 in 20) acid; fuses, and at 200° C. (392° F.) loses all water of crystallization; when strongly heated—loses sulphuric anhydride, becoming incompletely soluble in water. 2. Aqueous solution + ammonia water—white gelatinous precipitate, almost insoluble in excess. 3. With barium chloride T. S. —white precipitate, insoluble in hydrochloric acid; contains 99.5 p. c. of pure salt, and the label of container must indicate whether ammonium or potassium alum. *Impurities:* Heavy metals, iron, arsenic, alkali and earths. Dose, gr. 5–30 (.3–2 Gm.), with sugar, syrup, etc.; emetic, ʒj–2 (4–8 Gm.).

Preparation.—1. *Alumen Exsiccatum.* Exsiccated Alum, $AlNH_4(SO_4)_2$ or $AlK(SO_4)_2$. (Syn., Alum, Exsic., Dried Alum, Burnt Alum, Alumen Ustum; Fr. Alun calcine—desséché—brulé; Ger. Alumen ustum, Gebrannter Alaun.)

Manufacture: Heat alum (thin layer, in a tared, shallow porcelain dish) 100 Gm. on sand-bath until it liquefies; continue heat, not above 200° C. (392° F.), with constant stirring, until aqueous vapors cease and the dry white porous mass weighs 55 Gm.; cool, powder. It is a white powder; odorless; sweetish, astringent taste, absorbing moisture on exposure, slowly soluble in water (20), boiling water (1.5), insoluble in alcohol; dried in air-bath—loss 10 p. c.; contains 96.5 p. c. of pure anhydrous salt, and the label of the container should indicate whether from ammonium or potassium alum. *Tests* and *Impurities:* same as for alumen. Should be kept in well-closed containers and not dispensed if containing more than 10 p. c. of moisture.

Properties and Uses.—Astringent, irritant, emetic, purgative; hemorrhage, serous diarrhea, colliquative sweats, menorrhagia, hematuria, gastric intestinal catarrh, dysentery, diabetes, bronchitis, whooping-cough, lead colic, croup, narcotic poisoning, intermittent fever, ophthalmia, ecchymoses, sore throat, aphonia, ingrowing toe-nails, chilblains, ulcers, burns, relaxed gums, uvula, pharynx, vagina, anus, gonorrhea, gleet, leucorrhea, toothache. Dried Alum—astringent, stimulant, escharotic, more powerful than the preceding; fungous granulations, ulcers, insufflation. Both are applied locally in powder, lotion, injection, sprays, gargles (3–5 p. c.).

Incompatibles: Alkalies, lime, lead, mercury, iron salts, tartrates, tannin.

Allied Salts:

1. *Alumini Chloridum. Aluminum Chloride,* $AlCl_3.6H_2O$, *N.F.*—Obtained by passing chlorine over a mixture of Al_2O_3 and carbon at red heat. It is a white, yellowish-white, deliquescent crystalline powder, nearly odorless, sweetish, astringent taste, soluble in water (.5), alcohol (4), glycerin; contains salt corresponding to 20.5 p. c. of

Al_2O_3. Aqueous solution (1 in 10) clear, acid reaction; with silver nitrate T. S.—white curdy precipitate, insoluble in nitric acid; with ammonia water—white gelatinous precipitate, insoluble in excess; with sodium hydroxide T. S.—white gelatinous precipitate, soluble in excess. Astringent, antiseptic, disinfectant; solution of 1 part dissolved in water and mixed with alum 2 parts dissolved in water (filtering from precipitate of calcium sulphate) is valuable. Aluminum Gallate and Aluminum Tannate—good astringents in ozena; hyperidrosis (and lessening its odor), locomotor ataxia. Dose, gr. 5–10 (.3–.6 Gm.); 1. *Liquor Hydrastinæ Compositus,* $\frac{3}{10}$ p. c.

2. *Alumini Sulphas. Aluminum Sulphate,* $Al_2(SO_4)_3.18H_2O$, *N.F.*—Obtained by dissolving freshly precipitated aluminum hydroxide in diluted sulphuric acid, crystallizing or evaporating to dryness. It is a white crystalline powder, shining plates or crystalline fragments, odorless, sweetish, astringent taste, permanent, soluble in water (1), insoluble in alcohol, heated to 200° C. (293° F.) loses water of crystallization (45.7 p. c.); contains 99.5 p. c. of pure salt. Disinfectant, deodorant, antiseptic—similar to alum; leucorrhea, chronic dysentery, foul ulcers, cancer, nevi, polypi, fetid discharges, enlarged tonsils, nasal catarrh, diseases of os uteri, scrofulous sores; injection (50 p. c.) is of value in preserving subjects for dissection, but less so than zinc chloride. Not used internally; 1. *Liquor Alumini Acetatis,* Burow's Solution—lead acetate 15 Gm., aluminum sulphate 8.5, water q. s. 100 cc.; 2. *Liquor Alumini Subacetatis,* aluminum sulph. 16 Gm., acid. acet. 16 cc., calc. carb. præc. 7 Gm., water q. s. 100 cc.

3. *Alumini Hydroxidum. Aluminum Hydroxide,* $Al(OH_3)$.—Obtained by dissolving alum 10 Gm., monohydrated sodium carbonate 4.5 Gm. each separately in water 100 cc., filtering, heating to boiling, adding alum solution to sodium carbonate, stirring constantly, washing precipitate with hot water, draining, drying, powdering—$3Na_2CO_3 + 2AlNH_4(SO_4)_2 + 3H_2O = 3Na_2SO_4 + (NH_4)_2SO_4 + 2Al(OH)_3 + 3CO_2$. It is a white, bulky, amorphous powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in hydrochloric or sulphuric acid, fixed alkali hydroxides. Solution in hydrochloric or sulphuric acid + potassium hydroxide T. S.—white gelatinous precipitate, soluble in excess and reprecipitated by excess of ammonium chloride. Heated to redness—loses 34 p. c. of weight; consists principally of pure base. *Impurities:* Heavy metals, arsenic, alkali salts. Resembles medicinally bismuth oxide and magnesium oxide; feebly astringent, desiccant powder, antacid; used externally on skin in inflammations, dyspepsia, diarrhea, intertrigo, superficial burns.

4. *Kaolinum. Kaolin. Fuller's Earth,* $H_2Al_2Si_2O_8.H_2O$, *N.F.*—This native aluminum silicate, consisting chiefly of pure silicate, powdered and freed from gritty particles by elutriation, is found in large deposits in the earth, being the product of the weathering action of carbon dioxide and water on feldspar minerals (potassium aluminum silicate, $KAlSi_3O_8$), in which the potassium silicate formed is removed by rain-

water, absorbed by the soil, and in turn by plants, leaving behind insoluble kaolin. It is a soft, white, yellowish-white powder, lumps, earthy, clay-like taste, insoluble in water, cold dilute acids, alkali hydroxide solutions; moistened with water—darkens, developing clay-like odor. Mix 1 Gm. with distilled water 10 cc. + sulphuric acid .5 cc.—no effervescence, evaporate, heat until dense white fumes—gray residue on filter (impure silica); to portion of filtrate add ammonia water—gelatinous precipitate (aluminum hydroxide) insoluble in excess; to another portion, sodium hydroxide T. S.—gelatinous precipitate, soluble in excess. Ignite at red heat—85 p. c. remains. *Impurities:* Iron, etc.; 1. *Cataplasma Kaolini*, 56.5 p. c., acid. bor. 4.5, thymol $\frac{1}{20}$, methyl. salicyl. $\frac{1}{5}$, ol. menth. pip. $\frac{1}{20}$, glycerin 38.7—make into a homogeneous mass—resembles soft putty. Drying agent, emollient; to clarify, decolorize vegetable and animal oils (wine, beer, honey, syrups), dusting powder on irritated surfaces, sores, excipient for silver nitrate, potassium permanganate, etc.; Cataplasm—counter-irritant, exosmotic, antiseptic, due to the hygroscopic power of glycerin; induces superficial hyperemia, relieving deep-seated congestion, pain (pneumonia, pleurisy, bronchitis, peritonitis, sprains, boils, periostitis, mastitis, orchitis, etc.), replacing flaxseed and mustard poultices, liniments, antiphlogistine, etc., and should be applied freely and as hot as can be borne, being heated by placing container in boiling water; impaired by exposure.

Allied Metal:

1. *Cerium*, $Ce^{iv} = 140.25$. The element cerium (named by Berzelius, 1803, after asteriod *Ceres*, then just discovered, 1801) occurs sparingly in nature, chiefly in cerite, also in gadolinite, allanite, and orthite. Monzanite sand, N. Ca., contains cerite, also silicates or oxides or phosphates of other earthy metals, as zirconium, erbium, thorium. The oxide of thorium gives a bright white light at comparatively low temperature, on which account it is employed in the mantle of the *Welsbach* incandescent burner. Cerium resembles aluminum in chemical behavior, but its salts act medicinally like those of bismuth and silver. The metal itself is chocolate-brown, burning more easily than magnesium, oxidizing readily in moist atmosphere, and forms two oxides—*cerous*, Ce_2O_3, and *ceric*, CeO_2. *Tests for Cerium Salts:* 1. If to a colorless cerous salt sodium hypochlorite be added we get a red precipitate, which is soluble in warm HCl with evolution of chlorine. 2. Any residue, after heating a cerium salt, dissolved in H_2SO_4, and strychnine crystal added, gives a deep blue, changing to purple, then red (used as a strychnine reagent).

1. *Cerii Oxalas. Cerium Oxalate*, $Ce_2(C_2H_4)_3.9H_2O$, U.S.P. 1870–1910. —This salt consists chiefly of a mixture of the oxalates of cereum didymium, lanthanum, and other associated elements, and is obtained by digesting cerite (native silicate) with sulphuric acid, dissolving dried mass in diluted nitric acid and passing into the solution hydrogen

sulphide, to remove copper and other metals; to filtered solution add hydrochloric acid, to retain calcium salt, and oxalic acid to precipitate the cerite metals as oxalates, mix with magnesium carbonate, calcine to decompose oxalates, dissolve residue in nitric acid, and pour into water (large quantity) containing .5 p. c. of sulphuric acid to precipitate yellow ceric sulphate (lanthanum, didymium, and magnesium remaining in solution), dissolve ceric sulphate in sulphuric acid, reduce to cerous sulphate by sodium thiosulphate, and precipitate cerous oxalate with oxalic acid, dry. It is a fine white, slightly, pink powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, solutions of potassium or sodium hydroxide, insoluble in cold but soluble in hot diluted sulphuric or hydrochloric acid; heated to redness decomposes leaving 47 p. c. of the salt as oxides—reddish brown residue. Boil with potassium hydroxide T. S.—insoluble precipitate (white hydroxides); supersaturate filtrate with acetic acid, + calcium chloride T. S.—white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid. Dissolve in diluted hydrochloric or sulphuric acid, + potassium hydroxide T. S.—precipitate (white hydroxides) insoluble in large excess of reagent but yellowish on exposure, + ammonium carbonate T. S.—white precipitate (cerium carbonate, +) somewhat soluble in large excess of reagent. *Impurities:* Heavy metals, arsenic, aluminum, zinc, carbonates. Nervous and gastric sedative, similar to bismuth subnitrate; nausea, vomiting of pregnancy, sea-sickness, asthma, uterine, disorders, hysteria, dyspepsia, pyrosis, cough of phthisis, bronchitis, chorea. Dose, gr. 1–10 (.06–.6 Gm.), ter die, in powder, pill, water.

FERRUM. IRON.

$Fe^{ii} = 55.84$. $Fe_2^{vi} = 111.68$. ($Fe^{iii} = 55.84$.).

The element iron (AS, *iren*, Goth, *iarn*, metal; L. *ferrum*) is the most useful and abundant of the heavier metals, being present in nearly all rocks, soils, animal and plant ashes, but seldom in the pure state. It occurs as sulphide—iron pyrites, FeS_2; as oxide—magnetic iron ore, FeO,Fe_2O_3; red hematite, Fe_2O_3; as carbonate—spathic iron ore, $FeCO_3$, and also combined with mineral acids. From any of these ores the metal may be obtained by reducing with carbon, which consists in heating in a blast furnace iron ore, coke, or coal, and some flux, as limestone or clay. This latter forms a more fusible aluminum and calcium silicate or slag. (1) $Fe_2O_3 + 3C = 2Fe + 3CO$. (2) $FeCO_3 + C = Fe + CO_2 + CO$. (3) $FeS_2 + 2O_2 = Fe + 2SO_2$. As such it is known as cast or pig iron, and is not pure by reason of its containing traces of silicon, sulphur, phosphorus, and carbon, 2–5 p. c. By puddling or refining, the carbon combines with a blast of oxygen and is blown out, leaving wrought or bar iron, having still present carbon .03–.3 p. c. Steel is a product intermediate between these two, containing carbon .5–2 p. c. Iron is hard, malleable, ductile, tenacious, grayish, fibrous texture; taste slightly styptic, odor slight, magnetic,

sp. gr. 7.7, least fusible of all useful metals excepting platinum, readily oxidizes in moisture and forms two kinds of salts, *ferrous* (lower) and *ferric* (higher). The metal itself and many important salts are official.

Tests for Iron Salts: 1. Ferrous salt with potassium ferrocyanide gives a nearly white precipitate, turning blue on exposure to air; with ferric salt have deep blue color at once—Prussian blue. 2. Ferrous salt with potassium ferricyanide gives at once deep blue color—Turnbull's blue; with ferric salts have greenish-olive color. 3. Ferrous salt with tannin has no effect; with ferric salt have greenish-black precipitate—ferric tannate (ink). 4. Ammonium sulphide gives black precipitate with both kinds of salts. 5. Ferrous salts with ammonia water give whitish precipitate, turning green, finally brown; with ferric salts have precipitate of brown ferric hydroxide.

Ferrum. Iron, *U.S.P.*—(Syn., Ferr., Iron wire, Mars; Fr. Fer (metallique), Fil de Fer; Ger. Eisen, Eisendraht.) Metallic iron in the form of fine, bright wire; the grease or paraffin oil used in coating for protection against moisture and oxidation (rust) should be removed previous to use. Wire in form of card teeth wastings is most convenient purest, and cheapest.

PREPARATIONS.—(Unoff): *Syrupus Ferri Phosphatis* (Br.), each ℥j (4 cc.) contains 1 gr. (.06 Gm.) ferrous phosphate, dose, ℥ss–1 (2–4 cc.). *Vinum Ferri* (Br.), 5 p. c. + sherry wine, dose, ℥j–4 (4–15 cc.).

Ferrum Reductum. Reduced Iron, *U.S.P.*—(Syn., Ferr. Reduct., Ferrum Redactum, Iron (reduced) by Hydrogen, Quevenne's Iron, Powder of Iron, Ferrum Hydrogenio Reductum, Ferrum Ope Hydrogenii Paratum; Fr. Fer. réduit par l'Hydrogène; Ger. Reduziertes Eisen.)

Manufacture: Freshly prepared ferric hydroxide (or subcarbonate), thoroughly washed and dried, is put into the central portion of a glass tube, the ends being filled with asbestos and corked, each cork being perforated by a smaller glass tube; the tube is put into a furnace and brought to red heat. Through this tube now is passed pure dry hydrogen, made from zinc and H_2SO_4, which is continued until furnace and tube have cooled—$Fe_2O_3 + 6H + \text{heat} = 2\,Fe + 3H_2O$. It is a very fine (No. 100 sieve) grayish-black, lusterless powder, odorless, tasteless, permanent (dry), insoluble in water, alcohol, heated in crucible until bluish-black color, without glowing, then quickly poured out—particles of iron glow brightly as they fall through the air, being converted into black ferroso-ferric oxide; contains 90 p. c. of metallic iron (Fe). *Tests:* 1. Shake with distilled water (5)—liquid does not change color of litmus. *Impurities:* Arsenic, sulphide, etc. Should be kept in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.), at meal-time, in pill, wafer.

PREPARATIONS.—1. *Extractum Ferri Pomatum, N.F.*, 4 p. c. 2. *Pilulæ Ferri Iodidi, N.F.*, 1 gr., ferr. reduct. 4 Gm., iodine 5, glycyrrh.

4, sucrose 4, ext. glycyrrh., acacia, āā 1 + ,100 pills. 3. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N.F.*, 1 gr., ferr. reduct. 6.5 Gm., quin. sulph. 6.5, strych. .32, arsen. triox. .32, honey q. s. 100 pills. 4. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites*, Aitken Tonic Pills, *N.F.*, ⅔ gr., ferr. reduct. 4.5 Gm., quin. sulph. 6.5, strych. .13, arsen. triox. .13, honey q. s. 100 pills.

Unoff. Prep.: Trochiscus Ferri Redacti (Br.), each 1 gr. (.06 Gm.).

Properties and Uses.—Chalybeate, tonic, astringent; anemia, chlorosis, etc., best given with a laxative, tonics, mild stimulants; feces and tongue usually black (sulphide); may produce headache with fulness—"iron headaches;" often temporarily stored in liver and spleen. Originally prepared by Quevenne, Paris, as a substitute for ferri subcarbonas, but owing to formation of H_2S, from impurities, often deranges stomach.

Liquor Ferri Chloridi. Solution of Ferric Chloride, *U.S.P.*—(Syn., Liq. Ferr. Chlor., Solution of Iron Perchloride, Liquor Ferri Muriatici Oxydati, Ferrum Sesquichloratum Solutium; Br. Liquor Ferri Perchloridi Fortis; Fr. Soluté de Perchlorure de Fer, Chlorure ferrique liquide; Ger. Liquor Ferri sesquichlorati (Flüssiges), Eisenchloridlösung.)

Manufacture: To a flask containing iron wire 12.5 Gm. add hydrochloric acid 42 Gm. diluted with distilled water 25 cc., heat on water-bath until effervescence ceases (1¼ hours), boil, filter, rinse flask and iron wire with little hot distilled water; to filtered liquid, including rinsings, add hydrochloric acid 22 Gm. and this mixture in a slow stream to nitric acid 6.5 Gm., warm gently; after effervescence ceases, heat until free from nitric acid; if solution black add nitric acid in drops until red fumes no longer escape, finally add hydrochloric acid 4 Gm., and distilled water q. s. 100 Gm. It is a yellowish-brown aqueous liquid, faint odor of hydrochloric acid; an acid, strongly styptic taste, acid reaction, sp. gr. 1.30; contains ferric chloride, $FeCl_3$, corresponding to 10–11 p. c. of iron. *Tests*: 1. Aqueous solution (1 in 10); with ammonia water—brownish-red precipitate; with potassium ferrocyanide T. S.—blue precipitate; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. *Impurities:* Zinc, copper, lead, salts of fixed alkalies, ferrous salts, free hydrochloric acid, nitrate. Should be kept dark, in glass-stoppered bottles. Dose, ♏ij–10 (.13–.6 cc., well diluted with water or syrup.

Preparations.—1. *Ferri Chloridum.* Ferric Chloride, $FeCl_3(Fe_2Cl_6.12H_2O)$. (Syn., Ferr. Chlor., Iron Perchloride, Sesquichloride of Iron, Ferrum Muriaticum Oxydatum, Ferri Perchloridum; Fr. Perchlorure de Fer, Chlorure ferrique; Ger. Ferrum sesquichloratum, Eisenchlorid.)

Manufacture: Evaporate on water-bath solution of ferric chloride 100 Gm. until it weighs 40 Gm., set aside to crystallize, break into pieces. It is in orange-yellow, brown-yellow crystalline pieces, odorless

or faint odor of hydrochloric acid, strongly styptic taste, very deliquescent, soluble in water (.2), alcohol, glycerin, ether, fuses at 35.5° C. (96° F.) to a reddish-brown liquid, strongly heated decomposes, leaving residue of ferric oxide; contains ferric chloride, $FeCl_3$, in hydrated form corresponding to 20 p. c. of iron. *Impurities:* Heavy metals, ferrous salt, nitrate. Dose, gr. 1–5 (.06–.3 Gm.).

2. *Tinctura Ferri Chloridi.* Tincture of Ferric Chloride. (Syn., Tr. Ferr. Chlor., Tinctura Ferri (Muriatis) Sesquichloridi; Br. Tinctura Ferri Perchloridi; Fr. Teinture de Perchlorure de Fer; Ger. Eisenchloridtinktur.)

Manufacture: Mix solution of ferric chloride 35 cc. with alcohol q. s. 100 cc. It is a bright, amber-colored, hydro-alcoholic liquid (solution), slight ethereal odor, very astringent, styptic taste, acid reaction, sp. gr. 1.000; contains ferric chloride, $FeCl_3$, about 13 p. c., corresponding to 4.48 p. c. of iron. *Tests:* 1. With ammonia water—brownish-red precipitate; with potassium ferrocyanide T. S.—blue precipitate; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. *Impurities:* Ferrous salt (due to reduction), nitrate. Should be kept dark, in amber-colored, glass stoppered bottles, and not dispensed for at least 3 months. Dose, ♏x-30 (.6–2 cc.).

Preps.: 1. *Liquor Ferri et Ammonii Acetatis.* Solution of Iron and Ammonium Acetate. (Syn., Liq. Ferr. et Ammon. Acet., Basham's Mixture, Mistura Ferri et Ammonii Acetatis.)

Manufacture: To solution of ammonium acetate 50 cc., which must be slightly acid, add, successively, diluted acetic acid 6 cc., tincture of ferric chloride 4, aromatic elixir 12, glycerin 12, distilled water q. s. 100 cc. It is a clear, reddish-brown liquid, sweetish, saline, afterward slightly astringent taste, aromatic odor, acid reaction, sp. gr. 1.039; contains in each 100 cc.: ammonium acetate corresponding to .6–.8 Gm. of NH_3 and .16–.20 Gm. of Fe. *Tests:* 1. With potassium ferrocyanide T. S.—blue precipitate, but the addition of ammonia T. S.—no precipitate. 2. Heat with potassium hydroxide T. S.—ammonia evolved. 3. To 5 cc. add sulphuric acid and alcohol, each 1 cc.—ethyl acetate formed, recognized by odor; must not be dispensed unless recently prepared, as it deteriorates by age. Dose, ʒj–4 (4–15 cc.), diluted.

2. *Elixir Chloridorum, N.F.,* 8.3 p. c.

2. *Ferri Oxidum Saccharatum, N.F.,* 2.8 p. c. Fe., liq. ferr. chlor. 30 Gm., sod. carb. monohyd. 11.2, water (300), sod. hydrox., sucrose, āā q. s. Dose, gr. 15–30 (1–2 Gm.).

Prep.: 1. *Syrupus Ferri Saccharati Solubilis, N.F.,* ferr. oxid. sacch. 41.5 Gm., syrup 32 cc., water q. s., 100 cc. Dose, ʒj–2 (4–8 cc.).

3. *Gossypium Stypticum, N.F.,* 80 cc.,+. 4. *Tinctura Ferri Chloridi Ætherea, N.F.,* 6 p. c., liq. ferr. chlor. 6 cc., ether 25, alcohol q. s. 100 cc., decolorize in the sun. Dose, ʒss–1 (2–4 cc.).

5. *Tinctura Ferri Citrochloridi*, Tasteless Tincture of Iron, *N.F.*, 35 p. c., liq. ferr. chlor. 35 cc., sod. cit. 45 Gm., alcohol 15 cc., water q. s. 100 cc. Dose, ♏v–15 (.3–1 cc.).

Preps.: 1. *Elixir Ferri, Quininæ et Strychninæ*, Elixir I. Q. & S., *N.F.*, 12.5 p. c., tr. ferr. citrochlor. 12.5 cc., quin. hydrochl. .875 Gm., strych. sulph. .0175, sp. aurant. co. 1 cc., alcohol 24, glycerin 30, aq. dest. q. s. 100 cc. Dose, ʒj–2 (4–8 cc.). 2. *Elixir Gentianæ et Ferri, N.F.*, 10 p. c., + elix. gent. q. s. 100 cc. 3. *Liquor Ferri Salicylatis, N.F.*, 12.5 p. c., tr. ferr. citrochlor. 12.5 cc., sod. salicyl. 12.5 Gm., ammon. carb. .65, acid. cit. .85, methyl. salicyl. $\frac{1}{5}$ p. c., glycerin 17.5, aq. dest. q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

Unoff. Prep.: Liquor Ferri Perchloridi (Br.), 25 cc., + aq. dest. q. s. 100 cc.

Properties and Uses.—Liquor Ferri Chloridi—styptic, when injected into vessels coagulates blood; used to cure varices, hemorrhages, incontinence of urine, vesical catarrh, leucorrhea, injection for aneurism, nasal polypi, erectile tumors; externally in varicose veins, hemorrhoids, vascular growths, ulcers, cancers, diphtheria, ophthalmia, chilblains, ingrown nails, ulcerated gums, gangrene, hydrocele, prolapsed rectum, sweating of the feet. Ferri Chloridum—powerful astringent, hemostatic; chiefly used locally for stanching hemorrhage, as in epistaxis, hemoptysis—by inhaling an atomized solution, leechbites, on gums after teeth extracted, uterine ulcers, lupoid skin diseases. Tinctura Ferri Chloridi—tonic in scrofula, diuretic; gonorrhea, gleet, leucorrhea, dysury, hemorrhages from uterus, kidneys, bladder, erysipelas, scarlatina, diphtheria, purulent infection of the blood, venereal warts, cancerous, fungous ulcers, injection in aneurisms, sweats, puerperal fever, chilblains, poisoning by rhus toxicodendron, acute articular rheumatism. Liquor Ferri et Am. Acetatis—astringent chalybeate, produces diuresis, decreased albuminuria, best preparation for anemia of Bright's disease. The astringency of these preparations can be neutralized with sodium bicarbonate or citrate. They as well as all other acid preparations should be taken through a glass tube, to prevent the liquids coming into contact with the teeth. If this be impossible at times, the mouth should then be rinsed well with water in which an alkali has been dissolved.

Syrupus Ferri Iodidi. Syrup of Ferrous Iodide, *U.S.P.*—(Syn., Syr. Ferr. Iod.; Fr. Sirop d'Iodure de Fer; Ger. Sirupus Ferri jodati, Jodeisensirup.)

Manufacture: Mix in a flask iron (fine, bright wire-card teeth) 2 Gm., iodine 6 Gm., water 20 cc., shake occasionally, checking reaction, if necessary, by placing flask in cold water; when solution becomes greenish and lost iodine odor, heat to boiling, add sucrose 10 Gm., when dissolved, filter into flask containing sucrose 75 Gm., rinse flask and iron with hot distilled water 24 cc., in divided portions, through the filter,

agitate until dissolved, warm if necessary, cool to 25° C. (77° F.), add hypophosphorous acid .5 cc. and distilled water q. s. 100 cc. It is a transparent, pale yellowish-green, syrupy liquid, sweet, strongly ferruginous taste, slightly acid reaction, sp. gr. 1.370; contains 6.5–7.5 ferrous iodide in 100 cc. (about 5 p. c.). *Tests:* 1. Mix 5 cc. with a few drops of potassium ferricyanide T. S.—blue precipitate. 2. Add to 5 cc. a few drops of starch T. S. + 3 drops of chlorine T. S.—liquid deep blue. *Impurities:* Free iodine, etc. Should be kept in completely filled, tightly-stoppered bottles. Dose, ♏x–40 (.6–2.6 cc.), in water, after meals.

PREPARATION.—1. *Pilulæ Ferri Iodidi, N.F.*, 1 gr. each.

PROPERTIES AND USES.—All of the ferrous iodide preparations are tonic, alterative, diuretic, emmenagogue; scrofula, anemia from scrofula; tuberculosis, secondary syphilis, skin affections, chronic rheumatism, amenorrhea, leucorrhea, swollen glands, etc.

Ferri Sulphas. Ferrous Sulphate, $FeSO_4.7H_2O$, *U.S.P.*—(Syn., Ferr. Sulph., Iron Protosulphate, Green Vitriol, Copperas, Sulfas Ferrosus, Ferrum Vitriolatum Purum, Vitriolum Martis Purum; Fr. Sulfate de Fer (ferreux); Ger. Ferrum sulfuricum, Ferrosulfat, Schwefelsaures Eisenoxydul.)

Manufacture: Dissolve iron wire in diluted sulphuric acid by aid of heat, evaporate, crystallize—$Fe_2 + 2H_2SO_4 = 2FeSO_4 + 2H_2$. It is in pale bluish-green, monoclinic prisms, odorless, saline styptic taste; efflorescent in dry air, rapidly oxidizes in moist air, becoming coated with brownish-yellow, basic ferric sulphate, when it should not be used officially; soluble in water (1.4), boiling water (.4), insoluble in alcohol; aqueous solution acid, crystals disintegrate at 115° C. (239° F.), losing most of its water of crystallization; contains 54.36–57.07 p. c. of anhydrous ferrous sulphate, corresponding to 99.5 p. c. of crystallized salt. *Tests:* 1. Aqueous solution with potassium ferricyanide T. S.—blue color or precipitate; with barium chloride T. S.—white precipitate insoluble in hydrochloric acid. *Impurities:* Heavy metals, free acid. Should be kept in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.).

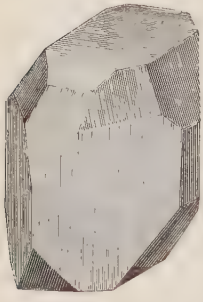


FIG. 462. — Ferrous sulphate crystal.

PREPARATIONS.—1. *Ferri Sulphas Exsiccatus.* Exsiccated Ferrous Sulphate, $FeSO_4$. (Syn., Ferr. Sulph. Exsic., Dried Ferrous Sulphate; Fr. Sulfate (ferreux) de Fer desséché; Ger. Ferrum sulfuricum siccum, Getrocknetes Ferrosulfat, Entwässertes (Schwefelsaures Eisenoxydul) Ferrosulfat.)

Manufacture: Allow ferrous sulphate 100 Gm. to effloresce in dry air at 40° C. (104° F.), heat on water-bath, constantly stirring, until it weighs 64–65 Gm., pulverize. It is a grayish-white powder, slowly soluble in water; aqueous solution (1 in 20) recently boiled and cooled—

only slightly turbid; contains 80 p. c. of anhydrous salt. Should be kept in tightly-stoppered bottles. Dose, gr. ½–3 (.03–.2 Gm.).

Preps.: 1. *Pilulæ Aloes et Ferri, N.F.*, āā 1 gr. (.06 Gm.). 2. *Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, N.F.*, ferr. sulph. exsic., quin. sulph., aloe, āā 1 gr., ext. nuc. vom. ¼ gr., ext. gentian q. s. each pill, Dose, 1–2 pills.

2. *Ferri Sulphas Granulatus.* Granulated Ferrous Sulphate, $FeSO_4.7H_2O$. (Syn., Ferr. Sulph. Gran., Precipitated Ferrous Sulphate; Fr. Sulfate ferreux précipité; Ger. Præcipitirtes Ferrosulfat.)

Manufacture: Add diluted sulphuric acid 5 cc. to distilled water 100, heat to boiling, in this dissolve ferrous sulphate 100 Gm., filter, evaporate to 150 Gm., cool quickly with constant stirring, when it crystallizes, drain crystals, pour upon them alcohol 25 cc., drain, spread on bibulous paper, dry quickly; the acid prevents oxidation of the ferrous sulphate, the alcohol removes acid and uncombined water, hence facilitates drying. It is a pale bluish-green, crystalline powder, responding to tests for ferri sulphas. Should be kept in tightly-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.).

Prep.: 1. *Pilulæ Ferri Carbonatis*, 2½ gr. (.16 Gm.)—1 gr. $FeCO_3$.

Unoff. Prep.: Mistura Ferri Composita, Griffith's Mixture, U.S.P. 1830–1900, rub until uniform myrrh 1.8 Gm., sucrose 1.8, pot. carb. ⅘, with aq. ros. 70 cc., add sp. lavand. 6, then ferr. sulph. crystals ¾, previously dissolved in aq. ros. 5, finally aq. ros. q. s. 100 cc.; dark green, and always should be fresh. Dose, ℥j–2 (30–60 cc.).

Properties and Uses.—Astringent, chalybeate, disinfectant. Overdoses cause nausea, vomiting, griping, purging, gastric inflammation; often not dissolved, thus causing impaction, which is best relieved by saline cathartics; hemorrhages, colliquative sweats, leucorrhea, gleet, chronic diarrhea, gastric catarrh, ulcers. With aloe relieves constipation. Externally—in ophthalmia, erysipelas. Ointment (dried sulphate 1 + lard 20) useful in skin diseases (eczema, intertrigo, impetigo), syphilitic and scrofulous sores.

Liquor Ferri Tersulphatis. Solution of Ferric Sulphate, *U.S.P.*— (Syn., Liq. Ferr. Tersulph., Solution of Iron Tersulphate, Solution of Normal Ferric Sulphate; Br. Liquor Ferri Persulphatis; Fr. Persulfate de Fer liquide; Ger. Flüssiges Schwefelsaures Eisenoxyd, Liquor Ferri Sulfurici Oxydati.)

Manufacture: Add sulphuric acid 9.6 Gm. to distilled water 25 cc., heat to nearly 100° C. (212° F.), add nitric acid 5.6 Gm., mix well; divide ferrous sulphate 50 Gm., coarsely powdered, into four equal portions, add one at a time to the hot liquid, stirring after each until effervescence ceases; if, after ferrous sulphate is dissolved, solution be black, add nitric acid by drops, heating and stirring, until red fumes cease to be evolved; boil until solution reddish-brown and free from nitric acid; add distilled water, a little occasionally, and finally q. s. 100 Gm., filter—$6(FeSO_4 + 7H_2O) + 3H_2SO_4 + 2HNO_3 = 3Fe_2$-

$(SO_4)_3 + 2NO + 46H_2O$, thus showing formation of normal salt, which is not true in liq. ferr. subsulph., *N.F.* It is a reddish-brown aqueous liquid, almost odorless, acid, strongly styptic taste, acid reaction, miscible with water and alcohol in all proportions, sp. gr. 1.432; contains normal ferric sulphate, $Fe_2(SO_4)_3$, corresponding to 9.5–10.5 p. c. of iron. *Tests:* 1. Aqueous dilution (1 in 20) with: (*a*) ammonia water—brownish-red precipitate; (*b*) potassium ferrocyanide T. S.—blue precipitate; (*c*) barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Nitrate, ferrous salt.

Preparation.—1. *Liquor Ferri Citratis, N.F.*, 73 p. c.; liq. ferr. tersulph. 73 cc., citric acid 37.5 Gm., ammonia water 110 cc., water q. s. 100 cc.; contains ferric citrate corresponding to 8.75 Gm. of Fe, with caramel odor. Should be kept in dark amber-colored bottles. Dose, ♏v–15 (.3–1 cc.).

Properties and Uses.—Powerful astringent, too irritating for general use, as externally it may cause sloughing sores owing to contained acid; its greatest service is in yielding ferric hydroxide for the basis of the scale salts of iron and the arsenic antidote.

Ferri Carbonas Saccharatus. Saccharated Ferrous Carbonate, $FeCO_3$, *U.S.P.*—(Syn., Ferr. Carb. Sacch., Carbonas Ferrosus Saccharatus; Fr. Saccharure (de Carbonate ferreux) de Proto-carbonate de Fer; Ger. Ferrum carbonicum cum Saccharo, Zuckerhaltiges (Kohlensaures Eisen) Ferrokarbonat.)

Manufacture: Dissolve sucrose 8.5 Gm. in hot distilled water 200 cc., and in this ferrous sulphate 50 Gm. + 3–5 drops of diluted sulphuric acid; dissolve sodium bicarbonate 35 Gm. in distilled water 500 cc., filter both solutions and add former to latter in a large flask, wash precipitate, until only slight cloudiness with barium chloride T. S., by filling flask several times with hot distilled water, siphoning off each time the clear, supernatant liquid; drain, transfer to a dish, mix intimately with sucrose 61.5 Gm., lactose 10 Gm., evaporate to dryness on water-bath, pulverize, mix with well-dried sucrose q. s. 100 Gm.—$(FeSO_4 + 7H_2O) + 2NaHCO_3 = FeCO_3 + Na_2SO_4 + CO_2 + 8H_2O$; contains 15 p. c. of ferrous carbonate. It is a greenish-brown powder, gradually oxidized by contact with air, odorless, sweetish, ferruginous taste; partially soluble in water, completely on adding hydrochloric acid with evolution of carbon dioxide, forming clear, greenish-yellow liquid. *Impurities:* Sulphate, etc. Should be kept dark, in small, well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), in pill.

Properties and Uses.—Takes the place of subcarbonate and the anciently used iron-rust in anemia, chlorosis, neuralgia, chorea.

Massa Ferri Carbonatis. Mass of Ferrous Carbonate, *U.S.P.*—(Syn., Mass Ferr. Carb., Vallet's Mass, Pill of Carbonate of Iron, Vallet's Ferruginous Pills, Pilulæ Ferratæ Valleti; Pilula Ferri Carbonatis; Fr. Masse pilulaire de Vallet—de Carbonate ferreux, Pilules de Carbonate

ferreux—ferrugineuses; Ger. Valletsche Pillenmasse, Pilulæ Ferri carbonici.)

Manufacture: Dissolve ferrous sulphate 100 Gm. and monohydrated sodium carbonate 46 Gm., each, in boiling distilled water 200 cc.; to iron solution add syrup 20 cc., filter both solutions, cool; add gradually the iron solution to that of sodium, in a bottle of 500 cc. capacity, frequently rotating bottle until carbonic acid gas no longer escapes; fill bottle with distilled water, cork, set aside for ferrous carbonate to subside, pour off supernatant liquid, wash precipitate with a mixture of syrup (1) and distilled water (19), by decantation, until washings no longer saline, drain, express, mix precipitate with honey 38 Gm. and sucrose 25 Gm., evaporate, with constant stirring, to 100 Gm.—$(FeSO_4 + 1H_2O) + (Na_2CO_3 + 1H_2O) = FeCO_3 + Na_2SO_4 + 8H_2O$; contains 35 p. c. of ferrous carbonate. It is greenish-gray when fresh, gradually deepening in color, but should not be brown the result of oxidation; often blackish-green on surface owing to escape of moisture. Dose, gr. 1–5 (.06–.3 Gm.), in pill, after meals.

Pilulæ Ferri Carbonatis. Pills of Ferrous Carbonate, *U.S.P.*—(Syn., Pil. Ferr. Carb., Chalybeate Pills, Blaud's Pills, Ferruginous Pills; Br. Pilula Ferri, Iron Pill, Pills of Iron; Fr. Pilules ferrugineuses (chalybés) de Blaud (Griffith); Ger. Blaudsche (Griffithsche) Pillen.)

Manufacture: Rub in a mortar potassium carbonate 8 Gm. with glycerin and water, each 5 drops, add granulated ferrous sulphate 16 Gm. and sucrose 4 Gm., previously triturated to uniform powder, rub mass thoroughly until greenish, and when reaction complete add tragacanth 1 Gm., althea 1 Gm., water q. s. 100 pills; each pill contains 1 gr. (.06 Gm.) of ferrous carbonate in a fresh state, resulting from double decomposition of the two salts. Dose, 1–2 pills.

Properties and Uses.—Tonic in debility of digestive organs; chlorosis, hysteria, phthisis, chronic catarrh.

Ferri Hydroxidum cum Magnesii Oxido. Ferric Hydroxide with Magnesium Oxide, *U.S.P.*—(Syn., Ferr. Hydrox. cum Mag. Oxid., Arsenic Antidote, Ferric Hydrate with Magnesia; Fr. Contre-poison de l'Arsenic; Ger. Gegengift (des Arseniks) der Arsenigsaure.)

Manufacture: Mix solution of ferric sulphate 40 cc. with water 125 cc., keep liquid in large, well-stoppered bottle; rub magnesium oxide 10 Gm. with cold water to a smooth, thin mixture, transfer to a bottle holding 1000 cc., and fill it three-fourths with water and keep tightly stoppered; when wanted for use, shake latter mixture to a thin, creamy consistence, and slowly add to it the diluted ferric sulphate, shake until smooth. The magnesium oxide 10 Gm. may be replaced by 300 cc. of magnesia magma, diluting with water q. s. for required volume. Always keep the two solutions on hand in separate bottles, ready for immediate use, so that antidote may quickly be prepared.

Properties and Uses.—Solely as an antidote to arsenic poisoning, when it may act by combination, although it is believed to envelop

largely the poison mechanically, thereby preventing its absorption; stomach should be emptied shortly after its administration, and should always be prepared freshly, as it becomes inefficient by age. Dose, ℥iv–6 (120–180 cc.).

Ferri et Ammonii Citras. Iron and Ammonium Citrate, *U.S.P.*—(Syn., Ferr. et Ammon. Cit., Ammonio-ferric Citrate, Soluble Ferric Citrate, Ferro-ammonium Citricum; Fr. Citras Ammonico-ferricus, Citrate de Fer et d'Ammoniaque (de Fer Ammoniacal); Ger. Citronensaures Eisenoxyd Ammonium (Ammoniak), Ferriammoncitrat.)

Manufacture: Add solution of ferric citrate 100 cc. to ammonia water 40 cc., evaporate mixture at 60° C. (140° F.) to syrup, dry on glass. It is in thin, transparent, garnet-red scales, granules, odorless, saline, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol, aqueous solution (1 in 20) neutral, slightly acid or alkaline, chars into ferric oxide; contains 16–18 p. c. of Fe. *Tests:* 1. Heat .1 Gm. with potassium hydroxide T. S. 5 cc.—brownish-red precipitate, ammonia evolved. 2. Aqueous solution (1 in 100) + ammonia T. S.—no precipitate, but darkens solution. *Impurities:* Ferric citrate, tartrate. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

Preparation.—1. *Elixir Carnis et Ferri, N.F.*, ferr. et ammon. cit. .875 Gm., ext. of beef 3.5, alcohol 20 cc., sp. aurant. co. ½, syrup 10, aq. dest. q. s. 100 cc. Should be kept cool, in amber-colored bottles. Dose, ℥j–3 (4–12 cc.).

Unoff. Prep.: Vinum Ferri; dissolve iron and ammonium citrate 4 Gm. in sherry wine 70 cc., add tincture of sweet orange peel 6 cc., syrup 10 cc., sherry wine q. s. 100 cc., filter after several days, dose, ℥j–4 (4–15 cc.).

Properties and Uses.—Tonic; chlorosis, anemia, etc.

Ferri Phosphas Solubilis. Soluble Ferric Phosphate, *U.S.P.*—(Ferr. Phos. Sol., Ferri Phosphas, U.S.P. 1910, Ferric Phosphate with Sodium Citrate, Ferri et Sodii Citrophosphas, Ferrum Phosphoricum cum Natrio Citrico; Fr. Citrophosphate de Fer. et de Soude; Ger. Natriumferricitrophosphat.)

Manufacture: Dissolve, by heat, ferric citrate 50 Gm. in distilled water 100 cc., add sodium phosphate (uneffloresced) 55 Gm., stirring until dissolved, evaporate to syrup, dry on glass. It is in thin, bright green, transparent scales, granules, odorless, acidulous slightly saline taste, permanent in the dark, and dry air, soon darkens unprotected, soluble in water, insoluble in alcohol; aqueous solution (1 in 10) slightly acid; contains 12 p. c. of iron. *Tests:* 1. Aqueous solution + ammonia T. S.—reddish-brown color. 2. Boil with sodium hydroxide T. S.—brownish-red precipitate, without evolving ammonia. *Impurities:* Pyrophosphate, ammonium salts. Should be kept dark, in well-closed containers. Dose, gr. 3–10 (.2–.6 Gm.).

PREPARATIONS.—1. *Elixir Cinchonæ Alkaloidorum et Ferri, N.F.*, 3.5 p. c. 2. *Elixir Gentianæ et Ferri Phosphatis, N.F.*, $1\frac{3}{4}$ p. c. 3. *Liquor Phosphatum Compositus, N.F.*, 3.5 p. c. 4. *Syrupus Ferri, Quininæ et Strychninæ Phosphatum*, Easton's Syrup, *N.F.*, 2 p. c., ferr. phos. sol. 2 Gm., quinine 2.6, strychnine .02, acid. phos. 5, glycerin 10, water 5, syrup q. s. 100. Dose, ʒj–2 (4–8 cc.).

Allied Products:

1. *Ferrum Albuminatum. Albuminized Iron. Iron Albuminate, N.F.*—Obtained by dissolving dried egg albumen (35) in water (1000), adding dialyzed iron (oxychloride of iron) solution (120) previously diluted with water (1000), washing precipitate, dissolving in dilute solution of sodium hydroxide (or sodium citrate), evaporating. It is in reddish-brown, lustrous granules, brown powder, odorless, slight odor, freely soluble in water (solutions—dark), almost insoluble in alcohol, neutral, slightly alkaline, Aqueous solution + acids—precipitate, which dissolves upon warming with excess of hydrochloric acid; consists of iron oxide and albumin made soluble by sodium citrate; contains 17–19 p. c. of iron. *Impurities:* Ionic iron, sugar. Chalybeate; chlorosis, anemia; little advantage, if any, over some older iron preparations. Dose, gr. 5–15 (.3–1 Gm.); 1. *Liquor Ferri Albuminati*, 5 p. c., ferr. album. 5 Gm., aq. cinnam. 20 cc., elix. arom. 40, alcohol 12, aq. dest. q. s. 100 cc. Dose, ʒj–3 (4–12 cc.).

2. *Ferrum Peptonatum. Peptonized Iron. Iron Peptonate, N.F.*—Obtained by treating a 10 p. c. aqueous solution of peptone (100) with dialyzed iron (oxychloride of iron solution (120), neutralizing exactly with sodium hydroxide solution, dissolving precipitate with sodium (hydroxide) citrate, evaporating. It is in dark brown, lustrous granules, brown powder, slight characteristic odor, freely soluble in water (solutions—dark), almost insoluble in alcohol; aqueous solution (1 in 20) neutral, slightly alkaline. Aqueous solution + acids—precipitate, which dissolves upon warming with excess of hydrochloric acid; consists of iron oxide and peptone made soluble by sodium citrate; contains 16–18 p. c. of iron. *Impurities:* Ionic iron, sugar. Chalybeate, practically free from astringency, and elements disturbing digestion; chlorosis, anemia; possibly not superior to iron citrate or soluble phosphate. Dose, gr. 5–15 (.3–1 Gm.); 1. *Liquor Ferri Peptonati*, $1\frac{3}{4}$ p. c., ferr. pepton. 1.75 Gm., sod. cit. 2, alcohol 15 cc., syrup 5, glycerin 5, ol. aurant. $\frac{1}{67}$, æth. acet. $\frac{1}{5\,0}$, vanillin $\frac{1}{5\,0\,0}$, aq. dest. q. s. 100 cc. 2. *Liquor Ferri Peptonati et Mangani*, $1\frac{3}{4}$ p. c., ferr. pepton. 1.75 Gm., mangan. cit. sol. .875, alcohol 15 cc., syrup 5, glycerin 5, ol. aurant. $\frac{1}{67}$, æth. acet. $\frac{1}{5\,0}$, vanillin $\frac{1}{5\,0\,0}$, aq. dest. q. s. 100 cc. Dose, each, ʒj–3 (4–12 cc.).

3. *Ferri Glycerophosphas. Ferric Glycerophosphate*, $Fe_2(C_3H_7O_6P)_3$, *N.F.*—Obtained by dissolving fresh ferric hydroxide in glycerophosphoric acid, evaporating, spreading on glass plates, drying. It is in yellowish-green, transparent, amorphous scales, greenish-yellow powder odorless, nearly tasteless, soluble in water (2), insoluble in alcohol;

aqueous solution acid, turbid when heated. Aqueous solution (1 in 20) + potassium ferrocyanide T. S.—dark blue color, then add hydrochloric acid—dark blue precipitate; heat powdered mixture of .1 Gm. salt + .5 Gm. potassium bisulphate—pungent vapors of acrolein evolved; contains salt corresponding to 14–16 p. c. of iron. *Impurities:* —Chloride, phosphate, sulphate. Tonic, nervine. Dose, gr. 3–10 (.2–.6 Gm.); 1. *Elixir Glycerophosphatum Compositum*, $\frac{3}{10}$ p. c.

4. *Ferri Hypophosphis. Ferric Hypophosphite*, $Fe(PH_2O_2)_3$, *N.F.*—Obtained by adding a solution of sodium or calcium hypophosphite to a solution of ferric chloride or sulphate, washing and drying precipitate with moderate heat—$6NaPH_2O_2 + Fe_2Cl_6 = 2Fe(PH_2O_2)_3 + 6NaCl$; may also be made from iron sulphate and calcium hypophosphite, when the solution contains ferrous hypophosphite, which upon evaporation becomes ferric. It is a white, grayish-white powder, odorless, nearly tasteless, permanent, soluble in water (2300), boiling water (1200), more readily soluble in presence of hypophosphorous acid or strong solution of alkali citrate, this latter forming green solution. When strongly heated in test-tube—evolves spontaneously inflammable hydrogen phosphide gas with final residue of ferric pyrophosphate; readily oxidized by nitric acid, etc.; contains 98 p. c. of salt, corresponding to 21.8 p. c. of iron. *Impurities:* Calcium, carbonate, phosphate, sulphate. Anemia, defective nerve nutrition. Should be kept in well-closed containers. Dose, gr. 3–10 (.2–.6 Gm.); 1. *Liquor Hypophosphitum Compositus*, .44 p. c. 2. *Syrupus Hypophosphitum Compositus*, .225 p. c.

5. *Ferri Lactas. Ferrous Lactate*, $Fe(C_3H_5O_3)_2.3H_2O$, *N.F.*—Obtained by digesting iron filings 15 Gm. in lactic acid 30 cc. + water 500 cc. until action ceases, filtering, crystallizing, or by double decomposition between ferrous sulphate and calcium lactate. It is a greenish-white crystalline powder or in crystalline masses, slightly characteristic odor, mild, sweet, ferruginous taste, soluble in water (40), boiling water (12), freely soluble in alkali citrate solutions, which become green, almost insoluble in alcohol. Strongly heated—froths, evolves dense, white, acrid fumes, chars, with final brownish-red residue; aqueous solution greenish-yellow, slightly acid, and portions (*a*) + potassium ferricyanide T. S.—deep blue precipitate, (*b*) + potassium ferrocyanide T. S.—light blue precipitate; contains 97 p. c. of pure salt. *Impurities:* Butyric acid, chloride, sulphate, sugar, readily carbonizable substances. Chalybeate, tonic. Should be kept in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.); 1. *Syrupus Calcii Lactophosphatis et Ferri*, .85 p. c.

6. *Ferri Pyrophosphas Solubilis. Soluble Ferric Pyrophosphate*, *N.F.*—Obtained by mixing ferric citrate 50 Gm., sodium pyrophosphate 50, water 100 cc., evaporate solution to syrup, dry on glass. It is in thin, apple-green, transparent scales, odorless, acidulous, slightly saline taste, permanent in dry air and darkness, exposed soon dis-

colored; soluble in water, insoluble in alcohol, slightly acid. Warm with sodium hydroxide T. S.—brownish-red precipitate without evolving ammonia; fuse .1 Gm. each of potassium nitrate and sodium carbonate, boil residue with distilled water 10 cc., filter—filtrate when nearly neutralized with highly dilute nitric acid, yields with silver nitrate T. S. a yellow precipitate. *Impurities:* Phosphate, etc.; contains 10 p. c. of iron. Chalybeate; anemia, etc. Should be kept dark, in well-closed containers. Dose, gr. 1–5 (.06–.3 Gm.); 1. *Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ*, 3.5 p. c., ferr. pyrophos. sol. 3.5 Gm., quin, sulph. .875, strychnine .014, acid. cit. .07, ol. aurant. .07 cc., alcohol 22.5, syrup 37.5, aq. ammon. q. s., aq. dest. q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

7. *Ferri Oxidum Saccharatum. Saccharated Ferric Oxide, N.F.*—Obtained by diluting solution of ferric chloride 30 Gm. with water 150 cc. and gradually add to it monohydrated sodium carbonate 11.2 Gm., previously dissolved in water 150 cc.; wash precipitate (magma) thoroughly, transfer it to porcelain dish on water-bath, add sucrose 50 Gm. and a 15 p. c. solution of sodium hydroxide (not more than 5 Gm.) q. s. to clarify, evaporate to dryness; contains the equivalent of 2.8 p. c. of iron (Fe.). Dose, gr. 15–30 (1–2 Gm.); 1. *Syrupus Ferri Saccharati Solubilis*, 41.5 p. c., ferr. oxid. sacch. 41.5 Gm., syrup 32 cc., water q. s. 100 cc. Dose, ʒj–2 (4–8 cc.).

8. *Liquor Ferri Subsulphatis. Solution of Ferric Subsulphate. Monsel's Solution, N.F.*—Obtained by adding sulphuric acid 5.5 Gm. to distilled water 80 cc., heating to nearly 100° C. (212° F.), adding nitric acid 7.5 cc., mixing well; divide ferrous sulphate 104.5 Gm., coarsely powdered, into four equal portions, add one at a time to the hot liquid, stirring after each until effervescence ceases; if, after ferrous sulphate is dissolved, solution be black, add nitric acid by drops, heating and stirring, until red fumes cease to be evolved; boil until solution red and free from nitric acid, add distilled water, a little occasionally, and finally q. s. 100 Gm., filter. It is a dark reddish-brown aqueous liquid, odorless or nearly so, acid, strongly styptic taste, acid reaction, miscible with water and alcohol without decomposition, sp. gr. 1.548; contains basic ferric sulphate ($Fe_4O(SO_4)_5$?) corresponding to 20–22 p. c. of iron. Aqueous dilution (1 in 20) with: (*a*) ammonia water—brownish-red precipitate; (*b*) potassium ferrocyanide T. S.—blue precipitate; (*c*) barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Nitric acid, ferrous salt. When solution crystallizes into a semi-solid whitish mass gently heating restores the liquid condition. Owing to its deficiency in H_2SO_4, this solution when evaporated yields a salt less irritating than the liquor tersulphatis, and one having greater astringency. It was introduced in 1857 by M. Monsel to coagulate blood, hence of use in hemorrhages from cuts, wounds, where irritation is to be avoided, chancre, hemoptysis, diarrhea, hemorrhages from stomach, bowels, etc. Should be kept not under 22° C.

(70° F.), in well-stoppered amber-colored bottles. Dose, ♏iij–10 (.2–.6 cc., well diluted. When physicians order solution of persulphate of iron, this preparation should be dispensed.

9. *Ferri Ramenta. Iron Filings*, U.S.P. 1830–1850.—Such as are wholly attracted by the magnet. Owing to the magnet not being a perfect purifier, as it attracts and takes up other substances, and owing to so much copper being present in nearly all samples, they are no longer used officially.

10. *Ferri Bromidum. Ferrous Bromide*, $FeBr_2.6H_2O$.—Obtained by digesting bromine (2), iron wire or filings (1), water (10), until liquid becomes greenish, filtering, evaporating. It is a yellowish, styptic, deliquescent, soluble salt that should be employed cautiously. Dose, gr. 1–3 (.06–.2 Gm.); syrup, ♏xv–30 (1–2 cc.).

11. *Ferri Sulphidum. Ferrous Sulphide*, FeS.—Obtained by melting together small pieces of iron and sublimed sulphur; used only for generating hydrogen sulphide.

12. *Ferri Iodidum Saccharatum. Saccharated Ferrous Iodide.*—Obtained by mixing iron, as fine bright wire, 6 Gm., iodine 17 Gm., distilled water 20 cc., shaking occasionally until green color appears, filtering into lactose 40 Gm., evaporating to dryness with constant stirring, then adding reduced iron 1 Gm. to retard decomposition, and lactose q. s. 100 Gm. It is a yellowish-white powder, very hygroscopic, odorless, sweet, ferruginous taste, soluble in water (7), partially soluble in alcohol. *Impurities:* Salts of fixed alkalies, free iodine. Should be kept cool, in the dark, in dried, well-stoppered bottles. May be made by simply evaporating *Syrupus Ferri Iodidi*, but the continued application of heat liberates a part of the iodine giving a darker, less soluble, product, through the formation of ferric oxide. Dose, gr. 1–5 (.06–.3 Gm.), ter die.

13. *Ferri Oxalas. Ferrous Oxalate*, $FeC_2O_4.H_2O$, U.S.P. 1870–1880.—Obtained by dissolving ferrous sulphate 62 Gm. in water 1000 cc., also oxalic acid 28 Gm. in water 500 cc., filtering and mixing two solutions with agitation, washing and drying precipitate. It is a yellow, crystalline powder, odorless, nearly tasteless, permanent, slightly soluble in water, soluble in HCl or hot diluted H_2SO_4. Very similar to all other ferruginous compounds, but weak, hence little used. Dose, gr. 1–5 (.06–.3 Gm.).

14. *Ferri Subcarbonas. Subcarbonate of Iron*, $Fe_2O_3.Fe_2(OH)_6$, U.S.P. 1840–1870.—Made by mixing iron sulphate 225 Gm., dissolved in water 2000 cc., with sodium carbonate 250 Gm., dissolved in water 2000 cc., washing, drying the precipitate without heat. It is a reddish-brown powder, soluble in diluted HCl with slight effervescence; when dried by heat dissolves with difficulty in diluted HCl, as it then consists chiefly of the oxyhydrate, $Fe_2O_2.(OH)_2$. On exposure takes up oxygen, thus losing its original character and becoming a more insoluble oxide. Chalybeate tonic; anemia, anemic chlorosis, chorea,

neuralgia, ulcers, in emergency for arsenous acid poisoning—acts here mechanically and by combination; now replaced by ferri carbonas saccharatus. Dose, gr. 5–15 (.3–1 Gm.).

15. *Ferri Arsenas. Iron Arsenate*, $3Fe(FeO)AsO_4,16H_2O$.—Obtained by dissolving separately in water sodium arsenate and ferrous sulphate, mixing, neutralizing solution with sodium bicarbonate, washing, drying precipitate. A greenish amorphous powder, insoluble in water; contains 31.68 p. c. As_2O_5 + 26.4 p. c. water. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

16. *Ferri Hydroxidum. Ferric Hydroxide*, $Fe(OH)_3$, U.S.P. 1840–1900.—Obtained by diluting ammonia water 138 cc. with water 500 cc., constantly stirring, and to this adding solution of ferric sulphate 100 cc., previously diluted with water 1000 cc.; wash precipitate several times with water 1000 cc., finally mix it with water q. s. 300 Gm.—if order reversed, have formed basic ferric sulphate; when wanted for arsenous acid poisoning in great haste, much washing may be omitted, as the retained ammonia serves as a stimulant, thus neutralizing some of the depressing effects of the poison. It is a brownish-red magma, soluble in hydrochloric acid without effervescence. Largely as an antidote to arsenic poisoning, a very good substitute for official: *Ferri Hydroxidum cum Magnesii Oxido.* Dose, ʒj–4 (4–15 Gm.).

17. *Ferrum Dialysatum. Dialyzed Iron.*—Obtained by saturating aqueous solution of ferric chloride with fresh ferric hydroxide, putting into a dialyzer and suspending in water; all the acid passes through the septum, but very little iron. Used like *Tinctura Ferri Chloridi*, with the advantages of having no styptic taste, not staining, nor constipating; antidote for arsenic when followed by solution of sodium chloride. Dose, ♏v–30 (.3–2 cc.), diluted with water.

18. *Ferri Citras. Ferric Citrate*, $Fe_2(C_6H_5O_7)_2,6H_2O$, U.S.P. 1850–1900.—Obtained by dissolving fresh ferric hydroxide in water + citric acid, concentrating on water-bath at 60° C. (140° F.) to syrupy consistence, spreading on glass plates to dry in dust-proof closets; higher temperature prevents scaling and reduces to ferrous compound; yield 42–44 p. c., by weight, of solution used. It is in thin, transparent, garnet-red scales, odorless, slight ferruginous taste, soluble in water, insoluble in alcohol, chars into ferric oxide; contains pure salt corresponding to 16 p. c. of metallic iron. *Impurities:* Alkali citrates, tartrates. Mild tonic; delicate stomachs, children, with or without food. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

19. *Ferri Valeras. Ferric Valerate*, $Fe_2(C_5H_9O_2)_6$, U.S.P. 1880–1890.—Obtained by precipitating diluted solution ferric sulphate (or chloride) with cold solution sodium valerate (valerianate), washing, drying precipitate. It is a dark brick-red amorphous powder, varying composition, valerian odor, permanent, insoluble in cold water, soluble in alcohol; chars into ferric oxide; contains 15–20 p. c. of metallic

iron. Chalybeate tonic; anemia, nervous exhaustion, hysteria, diabetes insipidus. Dose, gr. 1–5 (.06–.3 Gm.).

20. *Ferri Ferrocyanidum. Ferric Ferrocyanide, Prussian Blue,* $Fe_4(Fe(CN)_6)_3$, U.S.P. 1820–1870.—Obtained by adding an aqueous solution potassium ferrocyanide to diluted solution ferric sulphate. It is dark blue, insoluble in water; poor chalybeate—its iron inert, cyanogen non-poisonous. Dose, ʒss–1 (2–4 Gm.).

21. *Ferri et Ammonii Tartras. Iron and Ammonium Tartrate,* U.S.P. 1860–1900.—Obtained by adding solution of ferric sulphate 100 cc., diluted with 1300 cc. of water, to ammonia water 110 cc., previously diluted with 250 cc. of water, washing precipitate; dissolve tartaric acid 14.5 Gm. in distilled water 200 cc., neutralize with ammonia water, add tartaric acid 14.5 Gm., heat until dissolved, then add the precipitate (ferric hydroxide) in portions; when dissolved filter, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red, reddish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 13 p. c. of metallic iron. Mild chalybeate; anemia, etc. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.).

22. *Ferri et Potassii Tartras. Iron and Potassium Tartrate,* U.S.P. 1830–1900.—Obtained by preparing ferric hydroxide as in *Ferri et Ammonii Tartras;* heat potassium bitartrate 38 Gm. with distilled water 300 cc., gradually add the precipitate (ferric hydroxide) in portions, stir, when dissolved filter, let stand 24 hours, stir to incorporate the precipitate, add ammonia water q. s. to dissolve precipitate, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red, reddish-brown scales, odorless, sweetish, ferruginous taste, deliquescent, soluble in water, insoluble in alcohol; contains amount of salt corresponding to 15 p. c. of metallic iron. One of the richest preparations in iron, most agreeably tasting, least constipating and least irritating to stomach and bowels of the iron salts. Should be kept dark, in well-stoppered bottles. Dose, gr. 5–15 (.3–1 Gm.), ter die.

23. *Ferri et Strychninæ Citras. Iron and Strychnine Citrate,* U.S.P. 1870-1900.—Obtained by dissolving iron and ammonium citrate 98 Gm. in distilled water 100 cc.; dissolve strychnine 1 Gm. + citric acid 1 Gm. in distilled water 20 cc., mix solutions, evaporate to syrup, dry on glass. It is in thin, transparent, garnet-red, yellowish-brown scales, odorless, bitter, ferruginous taste, deliquescent, soluble in water, partially in alcohol; contains .9–1 p. c. of strychnine, and amount of salt corresponding to 16 p. c. of metallic iron; chars into ferric oxide, which should not be alkaline (abs. of citrates, tartrates of alkali metals). Should be kept dark, in well-stoppered bottles. Dose, gr. 1–5 (.06–.3 Gm.), in pill, solution.

Condensed Table giving some Basal Iron Preparations and Products therefrom; each single one, or set included within bracket, to right of its equation mark being manufactured from that individual product preceding it.

Ferrum =
- I. Liq. Fe Chlor. =
  1. Ferri Chloridum.
  2. Tr. Fe Chlor. = Liq. Fe et Am. Acetatis (Basham's Mixture), 2 p. c.
  3. Fe Hypophosphis (Pp. with Na Hypophosphite).
- II. Syr. Fe Iod. = Fe Iod. Saccharatum (20 p. c. FeI_2) = Pil. Fe Iod. (Blancard's).
- III. Fe Lactate = Syr. Hypophosphitum cum Ferro, 1 p. c.
- IV. Fe Sulph. =
  1. Fe Sulph. Exsic. = Pil. Aloes et Ferri.
  2. Fe Sulph. Gran.
  3. Fe Oxalas.
  4. Liq. Fe Subsulph.
  5. Liq. Fe Tersulphatis. =
     1. Fe et Am. Sulph.
     2. Liq. Ferri Citratis. =
        1. Fe Cit. =
           1. Fe et Quin. Cit.
           2. Fe et Quin. Cit. Sol. = Vin. Fe Amara.
           3. Fe Phos. Sol. = Elix., Glyc. and Syr. Fe, Quin. et S, Phos.
           4. Fe Pyrophos. Sol.
        2. Fe et Am. Cit. = 1. Fe et Strych. Cit. 2. Vin. Ferri.
     3. Fe et Am. Tart.
     4. Fe et K Tart.
     5. Fe Hydroxidum. =
        1. Reductum.
        2. Emplastrum.
        3. Trochisci.
     6. Fe Hydroxidum cum MgO.
     7. Fe Valeras (Valerianas).
     8. Liq. Fe Nit.
     9. Liq. Fe Acet.
     10. Fe Ferrocyanidum.
     11. Ferrum Dialysatum =
         1. Ferrum Albuminatum.
         2. Ferrum Peptonatum.
     12. Fe Glycerophosphas.
  6. Fe Carb. Sacch.
  7. Fe Subcarb.
  8. Massa Fe Carb.
  9. Mist. Fe Carb.
  10. Pil. Fe Carb.
  11. Fe Hypophosphis.
  12. Fe Arsenas.
- V. Fe Brom.
- VI. Syr. Fe. Brom. (10 p. c. $FeBr_2$).
- VII. Fe Sulphidum.

MANGANUM. MANGANESE.

$Mn^{ii+vi} = 54.93.$

The element manganese (L. corrupt. of *magnes*, from resemblance to the magnet, or from magnesia transposed, as both were confounded until 1740) is not of great importance in medicine; it occurs natively in considerable quantities as black oxide, MnO_2 (pyrolusite, hausmannite, braunite), as sesquioxide, Mn_2O_3, as carbonate, $MnCO_3$; from this latter the metal may be obtained by heating with charcoal—$MnCO_3 + 2C = Mn + 3CO$. It resembles iron very closely, but oxidizes easier, is harder and more brittle; sp. gr. 7.20.

Tests for Manganese Salts: 1. With ammonium sulphide get flesh-colored precipitate. 2. Na_2CO_3 or K_2CO_3 gives white precipitate insoluble in excess of ammonium carbonate. 3. Borax bead is violet or amethyst. 4. Heated with $Na_2CO_3 + NaNO_3$ get bluish-green mass, forming with water a green solution which turns red with an acid. The *N.F.* recognizes 3 salts:

Mangani Hypophosphis. Manganese Hypophosphite, $Mn(PH_2O_2)_2.H_2O$, *N.F.*—Obtained by mixing calcium hypophosphite (1) in solution, with manganese sulphate (1.31) in solution, stirring, setting in warm place for calcium sulphate to subside, filtering, evaporating, crystallizing. It is a pink, granular or crystalline powder, odorless, nearly tasteless, permanent, freely soluble in water, insoluble in alcohol. Aqueous solution (1 in 20) neutral or acid, (*a*) + ammonium sulphide T. S.—salmon-colored precipitate (manganese sulphide) soluble in acetic acid; (*b*), acidulated with hydrochloric acid and added, drop by drop with agitation, to an excess of mercuric chloride T. S.—white precipitate (mercurous chloride), which becomes gray (reduced to metallic mercury) upon addition of manganese solution. When heated strongly in test-tube—evolves spontaneously inflammable hydrogen phosphide, leaving residue of manganese pyrophosphate; contains 97 p. c. of pure salt. *Impurities:* Arsenic, calcium, carbonate, phosphate, sulphate. No longer believed that manganese is a constituent of the blood, but when present, simply accidental, however, may act like iron with various acid radicals (ions); hypophosphite used similar to calcium hypophosphite. Should be kept in well-closed containers. Dose, gr. 3–10 (.2–.6 Gm.); 1. *Liquor Hypophosphitum Compositus*, .22 p. c. 2. *Syrupus Hypophosphitum Compositus*, .225 p. c.

Mangani Citras Solubilis. Soluble Manganese Citrate, $Mn_3(C_6H_5O_7)_2$, *N.F.*—Obtained by rendering manganous citrate soluble by sodium citrate. It is a yellowish or pinkish-white powder, translucent scales, odorless, slightly bitter, astringent taste, permanent, dissolves slowly in water (4), more soluble in boiling water, nearly insoluble in alcohol. When heated, chars leaving residue which effervesces with acids, yielding intense yellow flame. Aqueous solution (1 in 20 (*a*), rendered

alkaline with ammonia water, warmed with ammonium sulphide T. S. —salmon-colored precipitate; (*b*), 10 cc. slightly acidulated with acetic acid + calcium chloride T. S. 2 cc.—clear white (cold), but white precipitate upon boiling; contains 48-52 p. c. of pure salt. *Impurities:* Heavy metals, iron, chloride, sulphate, tartrates and other readily carbonizable substances. Chalybeate, tonic, like iron; anemia, etc. Dose, gr. 3–5 (.2–.3 Gm.); 1. *Liquor Ferri Peptonati et Mangani*, .875 p. c.

Mangani Glycerophosphas Solubilis. Soluble Manganese Glycerophosphate, $MnC_3H_7PO_6$, *N. F.*—Obtained by rendering manganous glycerophosphate soluble by citric acid. It is a yellowish or pinkish-white powder, odorless, acid taste, soluble in water (4), alcohol dissolves the citric acid leaving residue nearly insoluble in water; aqueous solution strongly acid. Aqueous solution + excess ammonium sulphide T. S.—on standing salmon-colored precipitate, soluble in acetic acid; 5 cc. mixed with ammonium molybdate T. S.—no immediate yellow turbidity (abs. of phosphate), but on standing or heating—yellow precipitate. Heat powdered mixture of .1 Gm. + potassium bisulphate .5 Gm.—pungent vapors of acrolein evolved; contains 70–75 p. c. of pure salt. *Impurities:* Heavy, metals, chloride, phosphate, sulphate. Phosphaturia, neurasthenia, malnutrition. Dose, gr. 3–10 (.2–.6 Gm.); 1. *Elixir Glycerophosphatum Compositum*, $\frac{1}{5}$ p. c.

Allied Salts:

1. *Mangani Dioxidum Præcipitatum. Precipitated Manganese Dioxide*, MnO_2, U.S.P. 1900–1910.—Obtained by dissolving manganese sulphate 50 Gm. in 1000 cc. distilled water; add to ammonia water 250 cc. an equal volume distilled water, mix this with solution of hydrogen dioxide 250 cc., previously diluted with equal volume distilled water, pour this slowly into solution of manganese sulphate, let stand an hour, frequently stirring, wash precipitate with hot distilled water, drain, dry. It is a heavy, very fine, black powder, odorless, tasteless, permanent, insoluble in water, alcohol; heating with hydrochloric acid converts it into manganous chloride, with evolution of chlorine; at red heat gives off oxygen, being converted into reddish-brown manganous manganic oxide, Mn_3O_4; contains chiefly manganese dioxide, with small amounts of other oxides of manganese, corresponding to not less than 80 p. c. of MnO_2. *Tests:* 1. Boil .1 Gm. with 2 drops of hydrochloric acid, + lead peroxide .5 Gm. + nitric acid 5 cc., + distilled water 5 cc.—liquid reddish-violet color. *Impurities:* Insoluble substances. Tonic, alterative, after prolonged usage may act as cumulative poison, causing staggering, paraplegia; good in syphilis, chlorosis, scurvy, skin diseases, itch, porrigo, stomach pains, pyrosis, gastralgia, simple ulcers. Acts solely as a coating to stomach, like bismuth salts. Dose, gr. 3–10 (.2–.6 Gm.).

2. *Mangani Dioxidum. Manganese Dioxide*, MnO_2, U.S.P. 1860-1890.—This is the native crude manganese dioxide, containing 66 p. c.

of pure dioxide, MnO_2; it is a heavy, grayish-black, gritty powder, odorless, tasteless, permanent, insoluble in water, alcohol; soluble in sulphuric or hydrochloric acid. It is important: 1, for liberating chlorine from HCl or NaCl in making bleaching-powder, mercuric chloride, etc.; 2, for oxygen in laboratory work; 3, for furnishing manganese salts; 4, for black glazing to pottery; 5, for freeing glass from iron coloration; 6, for mixing with iron to furnish manganese steel (best); 7, in veterinary practice.

3. *Mangani Sulphas. Manganese Sulphate,* $MnSO_4.4H_2O$, U.S.P. 1860–1900.—Obtained by forming a thin magma of manganese dioxide and sulphuric acid, boiling, evaporating to dryness, heating to redness (to decompose iron sulphate), cooling, treating with water, evaporating filtrate to crystallization. It is in pale rose-colored, translucent, tetrahedral prisms, odorless, slightly efflorescent, bitter, astringent taste, soluble in water (1), insoluble in alcohol; contains 38 p. c. of water, 62–68 p. c. of pure salt. *Impurities:* Heavy metals, iron, zinc, magnesium, salts of alkalies. Tonic, cholagogue, styptic, large doses sedative to nerves and circulation, poisonous; no longer considered a good substitute for iron in chlorosis, anemia, impoverished system; ointment an irritant to enlarged glands, swollen joints, etc. Should be kept in well-stoppered bottles. Dose, tonic, gr. 3–10 (.2–.6 Gm.), pill, solution.

CHROMIUM.

$Cr^{ii+vi} = 52.$

The element chromium (Gr. χρῶμα, color, + *ium*—*i. e.*, salts are colored) is not of much service in medicine, as it enters into only one official compound. Natively it occurs mostly as chrome iron ore or chromite, FeO,Cr_2O_3, having analogous composition to magnetic iron ore, FeO,Fe_2O_3; forms two basic oxides, *chromous*, CrO, and *chromic*, Cr_2O_3, and an acid oxide, trioxide, CrO_3 (official); there is also the dioxide, CrO_2, and trichromic tetroxide, Cr_3O_4.

Tests for Chromium Salts: 1. NaOH, KOH, NH_4OH, and NH_3SH will each precipitate green chromic hydroxide, $Cr_2(OH)_6$. 2. Soluble lead salts added to a soluble chromate precipitate lead chromate (chrome yellow), $PbCrO_4$, insoluble in acetic acid, soluble in HCl and NaOH.

Chromii Trioxidum. Chromium Trioxide, CrO_3, *U.S.P.*—(Syn., Chrom. Triox., Chromic Acid (Anhydride), Acidum Chromicum, Anhydrous Chromic Acid; Fr. Acide chromique; Ger. Acidum chromicum, Chromsäure.)

Manufacture: Heat together, to solution, potassium dichromate (30), water (50), sulphuric acid (77.5), let stand 12 hours, drain crystals —$K_2Cr_2O_7 + 2H_2SO_4 = 2CrO_3 + 2KHSO_4 + H_2O$. Chromic acid proper, H_2CrO_4, like arsenous and carbonic acids, can exist only in solution and upon evaporating this the acid becomes the anhydride.

It is in small, needle-shaped crystals, rhombic prisms, dark purplish-red, metallic luster, odorless, destructive to animal and vegetable tissues, deliquescent, soluble in water (.6), boiling water (.5); decomposes in contact with organic solvents (alcohol, ether, glycerin), sometimes with dangerous violence (liberated oxygen); contains 95 p. c. of the anhydride. *Tests:* 1. Heat—dark, black, restored on cooling; fuses at 190° C. (374° F.) to reddish-brown liquid, which on cooling—dark red, brittle mass (often enclosing cavities filled with crystals), furnishing a scarlet powder. 2. Decomposes at 250° C. (482° F.) into green chromic oxide and free oxygen; protracted heating—residue (chromic oxide); warmed with hydrochloric acid—evolves chlorine. *Impurities:* Sulphuric acid, etc. Should be kept in glass-stoppered bottles, and not brought in contact with organic substances, as serious explosions are liable to result. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

Preparation.—(Unoff.): *Liquor Acidi Chromici* (Br.), 25 p. c.

Properties and Uses.—Antiseptic, disinfectant, deodorant, escharotic, astringent; coagulates albumin. Used externally on growths in the mouth, larynx, pharynx, nasal passages (polypi), rhinitis, gangrene, scorbutic, syphilitic, or gangrenous ulcers, tumors, bites of rabid animals, poisoned wounds, tinea, sycosis, lupus, sweating or tender feet, conjunctivitis, uterine hemorrhage, leucorrhea, gonorrhea, incontinence of urine. The aqueous solution is used mostly, 5–10 p. c., or even varying up to the strong acid.

Poisoning: Similar to potassium dichromate. Give emetics, then magnesium oxide or carbonate, sodium bicarbonate or borate, demulcent drinks (milk, egg-white), stimulants, heat, opium, stimulant enemas.

Allied Metal:

1. *Uranium,* $U^{ii+iv} = 238.2$.—The element uranium (fr. Gr. *οὐρανός,* the sky—*i. e.*, in allusion to the planet Uranus) was discovered in 1789 in a mineral long known and called pitch-blend (uraninite), but which was supposed to be an ore of zinc or iron. Metal may be obtained by decomposing the chloride with potassium or sodium, is permanent, and belongs to the chromium group having, however, the appearance and color of nickel, sp. gr. 18.7; forms two classes of compounds—*uranous*^{ii}, *uranic* (*uranyl*)^{iv}. *Tests for Uranium Salts.*—1. Ammonium sulphide precipitates black uranic sulphide. 2. Hydrogen sulphide—no precipitate, but reduces yellow uranic to green uranous salt. 3. Alkaline carbonates—yellow precipitate. 4. Potassium ferrocyanide—reddish-brown precipitate; fused with borax—clear, yellow glass, greenish on cooling.

1. *Uranii Nitras. Uranium Nitrate,* $UO_2(NO_3)_2.6H_2O$, U.S.P. 1910. —Obtained by treating finely powdered pitch-blend with nitric acid, removing from solution the several associated metals (lead, barium, bismuth, iron, zinc, radium, polonium, etc.). It is in light yellow prisms, odorless, bitter, astringent taste, efflorescent, radio-active,

soluble in alcohol, ether, water (1.2); aqueous solutions yellow, acid; contains 98 p. c. of pure salt. *Impurities:* Heavy metals, iron, manganese, zinc, alkaline earths, uranous compounds, sulphate, etc. .Antidiabetic—diabetes, increases quantity and specific gravity of the urine, which contains albumin and glucose; violent poison, producing severe gastro-enteritis, nephritis, reduction of hemoglobin, degeneration of bloodvessels and viscera, and oxygenating power of the blood; chiefly as an indicator, volumetric solutions, to detect morphine, arsenic and phosphoric acid; use cautiously. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{8}$–$\frac{1}{4}$ (.008–.016 Gm.).

ZINCUM. ZINC.

$Zn^{ii} = 65.37.$

(Syn., Speltrum; Fr. Speltre, Zinc; Ger. Zink.)

The metal zinc (Ger. *zinn*, tin, with which it formerly was confounded) in thin sheets, irregular, granulated pieces, molded into thin pencils, or as fine powder, U.S.P. 1820–1910, occurs natively as sulphide (zinc-blend), ZnS, as carbonate (calamine), $ZnCO_3$, as silicate, and as red oxide, and is obtained pure by subliming carbonate or oxide mixed with charcoal; the vaporized metal distils into receivers, where it solidifies. It is a bluish-white metal, crystalline fracture, in the form of thin sheets, irregular granulated pieces, molded into thin pencils, or in powder, sp. gr. 6.9–7.2 after it is rolled, tarnishes slowly with a film of oxide or carbonate, soluble in diluted sulphuric or hydrochloric acid with evolution of hydrogen and usually some insoluble residue; when heated at 100–150° C. (212–302° F.) becomes malleable, ductile, above 200° C. (392° F.) becomes sufficiently brittle to be powdered in an iron mortar; at 414° C. (777° F.) melts, and at 940° C. (1724° F.) boils and may be distilled; contains 99 p. c. of pure metal. *Impurities:* Arsenic, antimony, phosphorus, sulphur.

Tests for Zinc Salts: 1. With ammonium sulphide—white precipitate (zinc sulphide), soluble in mineral acids, not in acetic acid; only metal whose sulphide is white. 2. Caustic alkali, ammonia water—white precipitate (zinc hydroxide, $Zn(OH)_2$), soluble in excess of reagent. 3. Solution of potassium ferrocyanide—white precipitate (dist. from Mg, Al—no precipitate).

Zinci Chloridum. Zinc Chloride, $ZnCl_2$, *U.S.P.*—(Syn., Zinc. Chlor., Butter of Zinc; Fr. Chlorurétum Zincicum, Chlorure de Zinc; Ger. Zincum chloratum, Zinkchlorid, Chlorzink.)

Manufacture: Boil zinc in hydrochloric acid until dissolved—$2Zn + 4HCl = 2ZnCl_2 + H_4$; the solution contains also iron and lead, which may be removed by adding nitric acid to form ferric chloride, and then zinc carbonate to precipitate ferric hydroxide, filtering, evaporating; may also be made by evaporating official solution of

zinc chloride to dryness, adding near the end a little hydrochloric acid to avoid largely the formation of oxychloride. It is a white, nearly white, granular powder, porcelain-like masses, or molded into pencils, odorless; so intensely caustic as to make tasting dangerous unless dissolved in much water, very deliquescent; soluble in glycerin (2), water (.25), alcohol (1.3); aqueous solution (1 in 10) acid; when heated to 260° C. (500° F.) fuses to a clear liquid; at higher temperature 730° C. (1346° F.) partly volatilizes in dense, white fumes, partly decomposes with a residue of zinc oxide; contains 95 p. c. of pure salt. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate; with silver nitrate T. S.—white, curdy precipitate, insoluble in nitric acid, soluble in ammonia water; with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. 2. Add to 5 cc. of aqueous solution (1 in 10) sufficient sodium hydroxide T. S. to redissolve precipitate first formed, warm—no odor of ammonia. *Impurities:* Heavy metals, ammonium salts, oxychloride, sulphate, etc. Should be kept in small, glass-stoppered bottles. Dose, gr. $\frac{1}{10}$–$\frac{1}{2}$ (.006–.03 Gm.).

Preparation.—1. *Liquor Zinci Chloridi.* Solution of Zinc Chloride. (Syn., Liq. Zinc. Chlor., Burnett's Disinfecting Fluid; Fr. Chlorure de Zinc liquide, Solute de Burnett; Ger. Flüssiges Chlorzink, Chlorzinklösung.)

Manufacture: Add hydrochloric acid 84 Gm. to granulated zinc 24 Gm. and distilled water 25 cc., let stand until reaction ceases and acid saturated; pour off liquid, add nitric acid 1.2 Gm., heat at 115° C. (239° F.), until a portion removed and cooled, solidifies, cool, dissolve solidified mass in distilled water q. s. 100 Gm., then add precipitated zinc carbonate 1.2 Gm., agitate occasionally for 24 hours, set aside until clear by subsidence, separate clear solution by decantation or siphon; the nitric acid oxidizes iron into ferric chloride, while the zinc carbonate precipitates it as ferric oxide. It is a clear, colorless, slightly yellow, caustic, odorless, aqueous liquid (solution), acid reaction, sp. gr. 1.548; contains 48.5–52 p. c. of zinc chloride. Dose, $\mathfrak{m}\frac{1}{4}$-1 (.016–.06 cc.); seldom used internally.

Properties and Uses.—Alterative, antispasmodic, astringent, escharotic, caustic, antiseptic, disinfectant. Internally—in scrofula, epilepsy, chorea, nervous troubles. Externally—in cancerous affections, tumors, cancers, aneurism, malignant and morbid growths, lupus, ulcers of uterus, etc., leucorrhea, gonorrhea, hemorrhagic endometritis, cystic tumors, nasal polypi, abscesses, scrofulous glands; to fill carious teeth, vascular and thickened conjunctiva. The liquor is the weaker form, used chiefly to deodorize and disinfect sewers, sinks, water-closets, hospitals, dissecting-rooms, etc., for embalming, to preserve anatomical subjects. When diluted (1 in 18) used as injection in gonorrhea, leucorrhea, etc., and as wash for ulcers, abscesses, to destroy putrid odor, etc. The salt itself sometimes applied for caustic

purposes in pasty form, diluted 2–3–4–5 times with wheat flour, rye flour, or gluten.

Poisoning: Symptoms similar to violent corrosive irritant poison; corrosion of lips and mouth, burning in throat, stomach, bowels, vomiting (blood-stained), increased pulse and respiration, dyspnea, paralysis, cold surface, dilated pupils, coma, convulsions, death. Give alkalies, alkali carbonates, emetics, soap, milk, albumin, anodynes, opium, flaxseed poultices to abdomen, stimulants, tannin.

Zinci Sulphas. Zinc Sulphate, $ZnSO_4,7H_2O$, *U.S.P.*—(Syn., Zinc. Sulph., Vitriolum Album, White Vitriol; Fr. Sulfas Zincicus, Sulfate de Zinc, Vitriol blanc, Couperose blanche; Ger. Zincum sulfuricum, Zinksulfat, Schwefelsaures Zinkoxyd, Weisser Vitriol, Galitzenstein.) This is the most important zinc salt.

Manufacture: Dissolve zinc in diluted sulphuric acid, remove iron and lead (chlorides) with nitric acid and zinc carbonate—$2Zn + 2H_2SO_4 + H_2O = 2ZnSO_4 + H_4 + H_2O$. It is in colorless, transparent rhombic crystals, granular, crystalline powder, odorless, astringent, metallic taste, efflorescent in dry air, soluble in water (.6), glycerin (2.5), insoluble in alcohol, aqueous solution (1 in 10) acid; rapidly heated melts; strongly ignited partly decomposes losing water and sulphuric acid; contains 55.86–58.63 p. c. of anhydrous zinc sulphate, corresponding to 99.5 p. c. of crystallized salt. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate; with barium chloride T. S.—white precipitate. 2. Aqueous solution (1 in 10) with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. *Impurities:* Heavy metals, arsenic, alkalies, alkali earths, chloride, free acid. Should be kept in well-closed containers. Dose, tonic, astringent, gr. 1–3 (.06–.2 Gm.), in pill, after meals; emetic, gr. 10–15 (.6–1 Gm.), in tepid water.

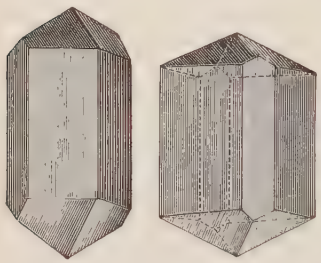


Fig. 463.—Zinc sulphate crystals.

Preparations.—1. *Lotio Alba Veterinaria, N.F.*, 2.3 p. c., zinc. sulph. 2.3 Gm., plumb. acet. 3, water q. s. 100 cc. 2. *Mistura Adstringens, N.F.*, 6.5 p. c. 3. *Pulvis Antisepticus, N.F.*, 12.5 p. c.

Unoff. Prep.: Unguentum Zinci Oleatis (Br.), zinc. sulph. 30 Gm., hard soap 90, aq. dest., soft paraffin, āā q. s.

Properties and Uses.—Tonic, astringent, emetic, gastric catarrh, nightsweats, epilepsy, chorea, croup, diphtheria, dysentery, typhoid fever, atonic dyspepsia, heart palpitation, spasmodic asthma, whooping-cough. Externally—aphthæ, conjunctivitis, gonorrhea, ophthalmia, throat and larynx affections, hemorrhages, nasal polypi, ulcers, tumors, lupus, eczema, itching, to remove urethral caruncles, condylomata,

warty excrescences. Caustic paste (℥j; 30 Gm. to glycerin ℥j; 4 cc.), caustic ointment (℥j; 30 Gm. to lard ℥ij; 8 Gm.), used as escharotic; injection, collyrium, and gargle ($\frac{1}{5}$–$\frac{1}{2}$ p. c.) are often useful.

Zinci Oxidum. **Zinc Oxide,** ZnO, *U.S.P.*—(Syn., Zinc. Oxid., Flores Zinci, Zinc-white, Nihil Album, Lana Philosophica; Fr. Oxydum Zincicum, Oxyde de Zinc; Ger. Zincum oxydatum (purum), Zinkoxyd, Philosophenwolle Zinkblumen.)

Manufacture: Heat precipitated zinc carbonate at 250–280° C. (482–536° F.) until all carbon dioxide and water expelled; the lower the heat the whiter, a red heat giving a yellow tint—$2ZnCO_3$, $3Zn(OH)_2$ = $5ZnO + 2CO_2 + 3H_2O$. It is a very fine, amorphous, white, yellowish-white powder, free from gritty particles, odorless, tasteless, gradually absorbs carbon dioxide from the air, insoluble in water, alcohol, soluble without effervescence in dilute acids, ammonia T. S., ammonium carbonate T. S.; strongly heated—yellow color, disappearing on cooling; contains when freshly ignited, 99 p. c. of pure oxide (ZnO). *Tests:* 1. Digest 1.3 Gm. in diluted hydrochloric acid and distilled water, each 10 cc.; with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate. *Impurities:* Iron, many metals, lead, alkali, carbonate, etc. Dose, gr. 1–5 (.06–.3 Gm.), in pill, ter die.

Preparations.—1. *Unguentum Zinci Oxidi.* Ointment of Zinc Oxide. (Syn., Ung. Zinc. Ox., Zinc Ointment, Ointment of Zinc; Br. Unguentum Zinci; Fr. Unguentum de Nihilo Albo, Pommade d'Oxyde de Zinc, Cérat épulotique; Ger. Unguentum Zinci, Zinksalbe.)

Manufacture: 20 p. c. Rub zinc oxide (free from gritty particles) 20 Gm. with melted paraffin 4 Gm. and white petrolatum 16 in warm container; with this incorporate, previously melted paraffin 11, and white petrolatum 49. If necessary, strain while warm and stir until congealed.

2. *Glycerogelatinum Zinci Durum, N.F.,* gelat. glycerin. 30 Gm., glycerin 25 Gm., zinc. oxid. 10, aq. dest. 35 cc. 3. *Glycerogelatinum Zinci Molle, N.F.,* gelat. glycerin. 20 Gm., glycerin 35 Gm., zinc. oxid. 10, aq. dest. 35 cc. 4. *Mulla Zinci, N.F.,* zinc. oxid. 10 Gm., sev. benz. 70, adeps benz. 20. 5. *Pasta Zinci, N.F.,* acid. salicyl. 2 Gm., zinc. oxid. 24, starch 24, petrolatum 50. 6. *Pasta Zinci Mollis, N.F.,* zinc. oxid. 25 Gm., calc. carb. præc. 25, acid. oleic. 2.5, ol. lini 25, liq. calc. hydrox. 22.5. 7. *Pasta Zinci Sulphurata, N.F.,* zinc. oxid. 15 Gm., sulphur præc. 10, ter. sil. purif. 5, adeps benz. 70. 8. *Linimentum Calaminæ, N.F.,* 8 p. c. 9. *Lotio Calaminæ, N.F.,* 8 p. c. 10. *Pasta Resorcinolis Fortis, N.F.,* 20 p. c. 11. *Pasta Resorcinolis Mitis, N.F.,* 25 p. c. 12. *Unguentum Picis Compositum, N.F.,* 3 p. c. 13. *Unguentum Resorcinolis Compositum, N.F.,* 6 p. c.

Properties and Uses.—Antispasmodic, astringent; chorea, epilepsy, whooping-cough, gastric and intestinal catarrhs, hysteria, spasmodic asthma, delirium tremens, colliquative sweats, diarrhea,

dysentery, diabetes insipidus. Externally—burns, scalds, fissures of nipples or anus, chancroids, intertrigo, ulcers, leucorrhea, skin eruptions, erysipelas, chronic ophthalmia, cosmetic, paint. Ointment is good form of application, having superseded the old Unguentum Tutiæ (tutty) made from impure zinc oxide—tutty (1 in 5).

Zinci Acetas. Zinc Acetate. $Zn(C_2H_3O_2)_2.2H_2O$, *U.S.P.*—(Syn., Zinc. Acet.; Fr. Acetas Zincicus, Acétate de Zinc; Ger. Zincum aceticum, Zinkacetat, Essigsaures Zinkoxyd.)

Manufacture: Dissolve zinc oxide (or carbonate) in hot, moderately diluted acetic acid, then filter, evaporate, crystallize—$ZnO + 2HC_2H_3O_2 = Zn(C_2H_3O_2)_2 + H_2O$. It is in soft, white, 6-sided, monoclinic plates, pearly luster, faintly acetous odor, and in dilute solutions astringent, metallic taste; on exposure gradually effloresces losing some acid, soluble in water (2.3), boiling water (1.6), alcohol (30), boiling alcohol (1); aqueous solution neutral, slightly acid; contains 83.16–87.32 p. c. of anhydrous zinc acetate, corresponding to 99.5 p. c. of crystallized salt; when heated partially fuses, losing water and acid; at higher temperature decomposes, evolving inflammable, empyreumatic vapors, with a residue chiefly of zinc oxide. *Tests:* 1. Aqueous solution (1 in 20) with potassium ferrocyanide T. S.—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate. 2. Add .1 Gm. to sulphuric acid and alcohol, each 1 cc., warm—ethyl acetate, recognized by odor; aqueous solution with ammonium carbonate T. S.—at first white precipitate, redissolved by excess of reagent. *Impurities:* Heavy metals, arsenic, etc. Should be kept in well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.).

Properties and Uses.—Astringent, irritant, emetic; erysipelas, delirium, diarrhea in typhoid, mostly externally in conjunctivitis, gonorrhea ($\frac{1}{5}$–$\frac{1}{2}$ p. c.). The injection is prepared usually by adding zinc sulphate and lead acetate, each gr. 12 (.8 Gm.) to water ℥viij (240 cc.), which by double decomposition gives zinc acetate in solution and lead sulphate precipitated, this latter being most excellent for sheathing inflamed parts.

Zinci Stearas. Zinc Stearate, *U.S.P.*—(Syn., Zinc. Stear.; Fr. Stéarate de Zinc, Zinc Stéarate; Ger. Zinkstearat.)

Manufacture: By mutual decomposition between zinc acetate (100) or sulphate (131) and sodium stearate (279), both salts being dissolved previously in boiling water; wash precipitate with hot water, dry, pulverize. It is a fine, white, bulky powder, tasteless, faint characteristic odor, free from grittiness, insoluble in water, alcohol, ether; neutral; when heated fuses; at higher temperature decomposes, emitting inflammable vapors with odor of burning fat, with a residue chiefly of zinc oxide; contains a small variable amount of palmitic acid, and zinc corresponding to 13–15.5 p. c. of zinc oxide. *Tests:* 1. Heat 1 Gm. with a mixture of distilled water 25 cc. and hydrochloric acid 5 cc.—

stearic acid liberated, floating on surface as an oily layer. *Impurities:* Alkalies, alkali earths.

PREPARATION.—1. *Unguentum Zinci Stearatis, N.F.*, 50 p. c., zinc. stear. 50 Gm., petrolat. alb. 50.

PROPERTIES AND USES.—Antiseptic, astringent, gonorrhea, atrophic rhinitis; apply in substance or combined with iodol, iodoformogen, or europhen (25 p. c.).

Allied Salts:

1. *Zinci Phenolsulphonas. Zinc Phenolsulphonate* $(C_6H_5O.SO_3)_2$-$Zn.8H_2O$, *N.F.*—Obtained by heating for 6 hours equal weights of phenol and sulphuric acid, neutralizing with barium carbonate, double decomposing this solution of barium phenolsulphonate with solution of zinc sulphate, evaporating, crystallizing. It is in colorless, transparent, rhombic prisms, tabular crystals, granules, odorless, astringent, metallic taste, effloresces on exposure to air and light, becoming slightly pink; soluble in water (1.6), boiling water (.4), alcohol (1.8); aqueous solution (1 in 10) acid; heated to 125° C. (257° F.) loses all water of crystallization; at higher temperature chars, emitting inflammable vapors with odor of phenol, and an incombustible residue; contains 73.7–77.4 p. c. of anhydrous zinc phenolsulphonate, corresponding to 99.5 p. c. of the crystallized salt. Aqueous solution (1 in 20) with potassium ferrocyanide—white, gelatinous precipitate; with ammonium sulphide T. S.—white precipitate; with ammonium carbonate T. S.—white precipitate, redissolved in excess of reagent. 2. Aqueous solution (1 in 100) with ferric chloride T. S.—pale violet color. *Impurities:* Heavy metals, arsenic, sulphate. Chiefly as a substitute for phenol (carbolic acid)—externally; antiseptic, astringent, stimulant for foul ulcers, mucous membrane inflammations, to prevent septicemia in surgical operations (1–5 p. c. solution); gonorrhea, leucorrhea, etc. (injection, 1–5 in 1000). Should be kept in small, well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.); 1. *Liquor Iodi et Zinci Phenolsulphonatis*, 15 p. c.

2. *Calamina Præparata. Lapis Calaminaris, N.F.*—This is native zinc carbonate calcined in a closed earthen crucible by moderate heat, powdered, and freed from gritty particles by elutriation. It is a pink powder passing through No. 100 sieve; insoluble in water, dissolved by mineral acids with slight residue; contains small amounts of ferric oxide and silica, and 98 p. c. ZnO. *Impurities:* Calcium, lead, magnesium, alkaline substances. Similar to zinc oxide; cutaneous troubles, where its skin-like color makes it preferable in ointments, powders, washes; 1. *Linimentum Calaminæ*, 8 p. c., calamin. præp. 8 Gm., zinc. oxid. 8, ol. oliv. 50 cc., liq. calc. hydrox. q. s. 100 cc. 2. *Lotio Calaminæ*, 8 p. c., calamin. præp. 8 Gm., zinc. oxid. 8, glycerin 2, liq. calc. hydrox. q. s. 100 cc. 3. *Lotio Calaminæ Composita*, phenol. liq. 1 p. c., lot. calam. 99 cc. 4. *Unguentum Calaminæ*, Turner's Cerate, 17 p. c., calamin. præp. 17 Gm., ointment 83.

3. *Zinci Carbonas Præcipitatus. Precipitated Zinc Carbonate,* $2ZnCO_3.3Zn(OH)_2(?)$, U.S.P. 1850-1910.—Obtained by adding slowly a solution of zinc sulphate to a boiling solution of sodium carbonate, constantly stirring, thereby avoiding the formation of normal instead of basic salt, that which is desired—$5(ZnSO_4 + 7H_2O) + 5(Na_2CO_3 + 10H_2O) = 2ZnCO_3, 3Zn(OH)_2 + 3CO_2 + 5Na_2SO_4 + 82H_2O$. It is an impalpable, white powder, odorless, tasteless, permanent, insoluble in water, alcohol; soluble in diluted acids with copious effervescence, also in ammonia water, ammonium carbonate T. S.; strongly heated loses water and carbon dioxide, with a yellow residue, becoming white on cooling; it is a basic zinc carbonate of somewhat variable chemical composition, corresponding to 68 p. c. of zinc oxide. *Impurities:* Heavy metals, alkali, etc. Astringent, protective, absorbent, chiefly externally for healing blisters, superficial sores, intertrigo, abrasions; in ointment, which now is substituted for the once popular Turner's cerate, made from impure native carbonate—calamine; may simply dust the powder on inflamed surfaces.

4. *Zinci Valeras. Zinc Valerate,* $Zn(C_5H_9O_2)_2.2H_2O$, U.S.P. 1860–1910.—Obtained by mixing hot solutions of zinc sulphate and sodium valerate; sodium sulphate remains in solution while zinc valerate separates in scaly crystals coming to the surface, the yield increasing upon evaporation—$ZnSO_4 + 2NaC_5H_9O_2 = Zn(C_5H_9O_2)_2 + Na_2SO_4$. It is in white, pearly scales, white powder, odor of valeric acid, sweetish, astringent, metallic taste; on exposure slowly loses valeric acid becoming partially insoluble in water; soluble in alcohol (22), water (70), a basic insoluble salt tending to form; aqueous solution (1 in 100) acid; gently heated melts; at higher temperature decomposes emitting inflammable vapors with a residue chiefly zinc oxide; contains 99 p. c. of crystallized salt. Dissolve .5 Gm. in a mixture of hydrochloric acid .5 cc. and distilled water 9 cc.—valeric (isovaleric) acid liberated, which floats on the surface as an oily layer. *Impurities:* Heavy metals, arsenic, acetate, butyrate. Antispasmodic, nervine, diabetes insipidus, neuralgia, epilepsy, chlorosis, nervous headache, vertigo, whooping-cough, convulsions, hysteria, chorea, cholera. Should be kept in small, well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.).

5. *Zinci Bromidum. Zinc Bromide,* $ZnBr_2$, U.S.P. 1880–1900.—Obtained by digesting granulated zinc in hydrobromic acid, evaporating, drying—$Zn + 2HBr = ZnBr_2 + H_2$; or digest zinc, bromine, and water together, evaporate. It is a white granular powder, odorless, taste sharp, saline, metallic, very deliquescent, soluble in water, alcohol; contains, when anhydrous, 97 p. c. of pure salt. *Impurities:* Lead, copper, cadmium, arsenic, chloride, iodide, sulphate. Antispasmodic, hypnotic, nervine, tonic, irritant poison; epilepsy. Should be kept in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.).

6. *Zinci Iodidum. Zinc Iodide,* ZnI, U.S.P. 1880–1900.—Obtained by dissolving zinc oxide, carbonate, or metal, in hydriodic acid; or digest metal with iodine and water, evaporate to dryness—(1) $Zn + 2HI =$

$ZnI_2 + H_2$. (2) $Zn + I_2 + H_2O = ZnI_2 + H_2O$. It is a white granular powder, odorless, sharp, saline, metallic taste, very deliquescent, on exposure turning brown from liberated iodine, soluble in water, alcohol, ether, heated leaves residue of zinc oxide; contains when anhydrous, 98 p. c. of pure salt. Alterative, astringent, caustic; chorea, scrofula, hysteria. Externally—similar to chloride in enlarged tonsils, tumors, gonorrhea, leucorrhea; applied as ointment 10 p. c., or solution 2–5 p. c., or injection $\frac{1}{5}$–$\frac{1}{2}$ p. c. *Impurities:* Lead, copper, cadmium, arsenic, chloride, sulphate. Should be kept dark, in small, glass-stoppered bottles. Dose, gr. 1–3 (.06–.2 Gm.), in solution or syrup.

7. *Zinci Phosphidum. Zinc Phosphide,* Zn_3P_2, U.S.P. 1880–1890. —Obtained by fusing zinc and phosphorus; or pass phosphorus vapors in a current of dry hydrogen over fused zinc—$3Zn + 2P$ + heat = Zn_3P_2. It contains 25 p. c. of phosphorus, and is a gritty, dark gray powder, or in crystalline fragments of dark metallic luster, faint odor, phosphorus taste, insoluble in water, alcohol, soluble in diluted acids. Nervous stimulant, aphrodisiac, similar to phosphorus; defective nutrition of brain and spine, locomotor ataxia, paralysis, chlorosis, anemia, amenorrhea, etc. Should be kept in small, glass-stoppered vials. Dose, gr. $\frac{1}{16}$–$\frac{1}{3}$ (.004–.02 Gm.), in pill, powder, syrup, on empty stomach.

Allied Metal:

1. *Cadmium,* $Cd^{ii} = 112.4$. The element cadmium (Gr. καδμεία, calamine, $ZnCO_3$—the two carbonates resemble and often occur together), U.S.P. 1860–1870, is found sparingly in nature, associated with zinc ores, especially calamine —zinc carbonate. It is a white metal resembling tin, but heavier and more tenacious, crackles when bent, sp. gr. 8.7. The air has little effect upon it, but when heated it combines with 1 atom of oxygen, producing orange-red oxide, CdO; it combines with chlorine, bromine, iodine, and sulphur. *Tests for Cadmium Salts:* 1. With H_2S or ammonium sulphide get bright yellow sulphide. 2. NaOH or KOH produces white precipitate, insoluble in excess, while that of ammonia water is soluble in excess. 3. Sodium or potassium carbonates precipitate white cadmium carbonate; the salts of cadmium are little used in medicine, the sulphide to a considerable extent as a pigment.

PLUMBUM. LEAD.

$Pb^{ii} = 207.2$.

(Syn., Fr. Plomb; Ger. Blei.)

The element lead (AS. *lead,* heavy weight, plummet, L. *plumbum*), U.S.P. 1820–1830, is obtained mostly from native sulphide (galena), PbS, by roasting in a reverberatory furnace: (1) $PbS + O_3 = PbO + SO_2$. (2) $PbS + O_4 = PbSO_4$. (3) $PbS + 2PbO = 3Pb + SO_2$. (4) $PbS + PbSO_4 = 2Pb + 2SO_2$; or heat sulphide with iron—PbS +

Fe = FeS + Pb. Lead is a soft, fusible, heavy metal, sp. gr. 11.45, entering into the alloys of solder, shot, Britannia metal, type-metal, etc.

Tests for Lead Salts: 1. H_2S or NH_4SH precipitates insoluble black sulphide. 2. H_2SO_4, or soluble sulphate, precipitates white lead sulphate, insoluble in HNO_3. 3. Alkaline carbonates precipitate white basic lead carbonate insoluble in excess.

Plumbi Monoxidum. Lead Monoxide, PbO, *U.S.P.*—(Syn., Plumb. Monoxid., Plumbi Oxidum, U.S.P. 1910, Litharge, Oxide (Flowers) of Lead, Semi-vitrified Lead Oxide, Plumbum Oxydatum, Plumbi Oxidum Semi-vitreum; Fr. Oxyde de Plomb fondu, Protoxyde de Plomb; Ger. Lithargyrum, Bleiglätte, Bleioxyd.)

Manufacture: Heat metallic lead to whiteness (400–450° C.; 752–842° F.) in the air, the oxygen of which combines with the lead, forming lead oxide, while any silver present remains unchanged; if heated only to fusion, get yellow amorphous *massicot*, a less oxidized form. It is a heavy, reddish-yellow powder, or in minute scales, odorless, tasteless, on exposure absorbs moisture and CO_2, insoluble in alcohol, nearly so in water, soluble in acetic acid, diluted HNO_3, or warm solutions of fixed alkali hydroxides; heated, becomes darker, but on cooling assumes original color, fuses at red heat, when heated with charcoal—reduced to metallic lead. *Tests:* 1. Solution in diluted nitric acid (1 in 10) is colorless, when nearly neutralized by ammonia water, + hydrogen sulphide T. S.—black precipitate, + potassium iodide T. S.—yellow precipitate, + diluted sulphuric acid—white precipitate. *Impurities:* Carbonate, moisture. Should be kept in well-closed containers.

Preparations.—1. *Emplastrum Plumbi Oleatis.* Lead Oleate Plaster. (Syn., Emp. Plumb. Oleat., Emplastrum Plumbi, U.S.P. 1910, Lead Plaster, Diachylon Plaster, Litharge Plaster, Emplastrum Diachylon Simplex, Emplastrum Album Coctum; Fr. Emplastrum Simplex, Emplâtre simple (de Plomb—de Litharge); Ger. Emplastrum Lithargyri (Simplex), Bleipflaster, Emplastrum Cerussæ, Bleiweisspflaster.)

Manufacture: Heat olive oil 100 Gm. + lard 100 Gm. until liquefied, sift lead monoxide 100 Gm., through (80) sieve, upon surface of hot liquid, mix thoroughly, add gradually boiling water 35 cc., boil, constantly stirring and adding water occasionally, until mass homogeneous and a portion is pliable and tenacious in cold water; remove from fire and wash out glycerin with warm water (several times), free from water by kneading, roll into suitable size cylinders, and wrap in paper.

Prep.: 1. *Unguentum Plumbi Oleatis.* Ointment of Lead Oleate. (Syn., Ung. Plumb. Ol., Unguentum Diachylon, U.S.P. 1910, Diachylon Ointment, Ung. Diachyl., Unguentum Plumbi Hebræ, Hebra's Lead Ointment; Fr. Onguent (Pommade de) Diachylon; Ger. Bleipflastersalbe, Diachylonsalbe.)

Manufacture: Melt together lead oleate plaster 50 Gm., white petrolatum 49, with gentle heat, strain, cool, but not congeal, add oil of lavender 1 Gm., stir until cold.

2. *Liquor Plumbi Subacetatis,* 14 p. c.

PROPERTIES AND USES.—Chiefly externally and in combination, for burns, abraded surfaces, to allay inflammations; also enters into paints, flint glass, glazing of pottery, etc.; with KOH as caustic in condylomata, warts of glans penis and vagina, producing a superficial black slough. The emplastrum to prevent bed-sores, abrasions; if surface be large, plaster usually is substituted to avoid poisoning.

Plumbi Acetas. Lead Acetate, $Pb(C_2H_3O_2)_2.3H_2O$, *U.S.P.*—(Syn., Plumb. Acet., Sugar of Lead, Acetas Plumbicus, Saccharum Saturni, Cerussa Acetata; Fr. Acétate—Sucre de Plomb, Sucre—Sel de Saturne; Ger. Plumbum aceticum, Bleiazetat, Essigsaures Bleioxyd, Bleizucker.)

Manufacture: Act upon lead oxide (1) with 30 p. c. acetic acid (2), evaporate, crystallize—$PbO + 2HC_2H_3O_2 + \text{heat} = Pb(C_2H_3O_2)_2 + H_2O$; or expose lead plates to the combined action of air and vinegar. It is in colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, granular crystals, faintly acetous odor, sweetish, astringent, metallic taste, efflorescent, absorbing carbon dioxide, soluble in glycerin, water (1.4), boiling water (.5), alcohol (38); at 40° C. (104° F.) loses water of crystallization, at 75° C. (167° F.) liquefies in its water of crystallization, at 280° C. (536° F.) decomposes into metallic lead and lead oxide; contains 85.31–89.57 p. c. of anhydrous lead acetate, corresponding to 99.5 p. c. of crystallized salt. *Impurities:* Iron, copper, carbonate. Should be kept in well-closed containers. Dose, gr. ½–4 (.03–.26 Gm.), usually with opium.

FIG. 464. — Lead acetate crystal.

PREPARATIONS.—1. *Liquor Plumbi Subacetatis.* Solution of Lead Subacetate. (Syn., Liq. Plumb. Subacet., Goulard's Extract, Acetum Plumbicum (Saturni), Plumbum Hydrico-aceticum Solutum; Br. Liquor Plumbi Subacetatis Fortis; Fr. Sous-acétate de Plomb liquide, Extrait de Saturne (de Goulard), Vinaigre de Plomb (de Saturne); Ger. Liquor Plumbi subacetici, Bleiessig.)

Manufacture: Triturate lead monoxide 14 Gm. to smooth paste with distilled water 10 cc., transfer to bottle 100 cc. capacity, rinsing with distilled water 10 cc.; dissolve lead acetate 22 Gm. in distilled water 70 cc. and add it to lead oxide mixture; shake vigorously for 5 minutes, set aside 7 days, shaking frequently; filter, with protection from air, add distilled water q. s. 100 cc. It is a clear, colorless, aqueous liquid, odorless, very sweet, astringent taste, alkaline to litmus but not to phenolphthalein, on exposure absorbs carbon dioxide causing white precipitate, sp. gr. 1.250; contains lead subacetate corresponding

to 18 p. c. of lead. *Tests:* 1. Aqueous dilution (1 in 10), using recently boiled distilled water, with (*a*) hydrogen sulphide—black precipitate, (*b*) potassium iodide T. S.—yellow precipitate, (*c*) diluted sulphuric acid—white precipitate. 2. Add 1 cc. to mucilage of acacia (1 in 10) 5 cc.—dense white precipitate (dist. from normal lead acetate). *Impurities:* Iron, copper, normal lead acetate. Should be kept in well-stoppered bottles.

Preps.: 1. *Liquor Plumbi Subacetatis Dilutus. Lead Water, N.F.*, 3.5 p. c., liq. plumb. subacet. 3.5 cc., distilled water, recently boiled, 96.5 cc. It is an aqueous solution containing lead subacetate corresponding to .70–.80 Gm. of Pb in each 100 cc.; colorless liquid with slight turbidity, sweet astringent taste, alkaline reaction. Should be kept in small, well-filled, tightly stoppered bottles.

2. *Ceratum Plumbi Subacetatis. Goulard's Cerate, N.F.*, 20 p. c., liq. plumb. subacet. 20 Gm., wool fat 20, white wax 20, white petrolatum 38, camphor 2.

2. *Liquor Alumini Acetatis, N.F.*, 15 p. c.; colorless with faint acetic odor. 3. *Lotio Plumbi et Opii, N.F.*, $1\frac{3}{4}$ p. c., lead acetate 1.75 Gm., tr. opii 3.5 cc., water q. s. 100 cc. 4. *Pilulæ Opii et Plumbi, N.F.* opium pulv., plumb. acet., āā 1 gr. (.06 Gm.), each pill. 5. *Lotio Alba Veterinaria, N.F.*, 3 p. c. 6. *Mistura Adstringens, N.F.*, 4.2 p. c., plumb. acet. 4.2 Gm., copper sulph. 6.5, zinc. sulph. 6.5, acid. acet. dil. 74 cc., water q. s. 100 cc.

Unoff. Preps.: Unguentum Plumbi Subacetatis (Br.); strong solution of lead subacetate 12.5 p. c. *Glycerinum Plumbi Subacetatis* (Br.); strong solution of lead subacetate 50 p. c. *Pilula Plumbi cum Opio* (Br.); lead acetate (80), opium (12), syrup of glucose (8), dose, gr. 2–4 (.13–.26 Gm.). *Suppositoria Plumbi Composita* (Br.); each contains lead acetate 3 gr. (.2 Gm.), + opium 1 gr. (.06 Gm.).

Properties and Uses.—Astringent, sedative, large doses irritant poison, diarrhea, dysentery, internal hemorrhage, aneurism, tympanites, epilepsy, neuralgia, chorea, hysteria, bronchitis, whooping-cough, sweats. Externally—contusion, excoriations, fractures, sprains, gonorrhea, leucorrhea, chronic eczema, eye affections (conjunctivitis, etc.; wash or drops, $\frac{1}{5}$–$\frac{1}{2}$ p. c. in distilled water). Cerate—for excoriations, burns, scalds, chilblains, skin eruptions, acute inflammations.

Poisoning: From any of the lead salts, when acute have burning, sweetish taste, thirst, vomiting (whitish fluid, due to lead chloride), abdominal colic (relieved by pressure), abdominal muscles rigid, cramps in legs, paralysis of extremities, rapid, weak pulse, livid face, stupor, constipation, feces black (lead sulphide), cold skin, collapse, giddiness, coma, convulsions, death. Give magnesium or sodium sulphate, then induce vomiting, follow with purgative enema, demulcent drinks, egg-white, milk, stimulants, opium; for lead colic hot fomentation, opiates, evacuants; for chronic lead-poisoning (constipation and dark blue line along margin of gums, wrist-drop) give

iodides to saturation (Na, K, Ca), sulphurous baths, calomel, sulphuric acid, lemonade, friction to muscles, electricity, strychnine.

Allied Salts:

1. *Plumbi Iodidum. Lead Iodide,* PbI_2, *N.F.*—Obtained by mixing equal quantities (120 Gm.) of lead nitrate and potassium iodide, each dissolved separately in sufficient water (500 cc.), filtering, washing, drying precipitate—$Pb(NO_3)_2 + 2KI = PbI_2 + 2KNO_3$. It is a heavy, bright yellow powder, odorless, tasteless, permanent, soluble in fixed alkali solutions, water (1300), boiling water (200), separating on cooling in brilliant, golden-yellow, crystalline laminæ, slightly soluble in alcohol, soluble in concentrated solutions of alkali acetates, potassium iodide, or sodium thiosulphate, or hot solution ammonium chloride. Moderately heated—fuses to a thick, reddish-brown liquid, congealing on cooling to a yellow, crystalline mass, decomposed at higher heat with evolution of violet vapors of iodine, with residue of lead oxyiodide; contains 99 p. c. of PbI_2. *Impurities:* Acetate, nitrate, chromate, other insoluble foreign salts. Resolvent, alterative; tuberculous diseases, scrofulous tumors, ulcers, indolent swellings, malarial enlargement of spleen; ointment, 10 p. c., best form externally. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{2}$–4 (.03–.26 Gm.), ter die, in pill; 1. *Unguentum Plumbi Iodide,* 10 p. c., plumb. iod. 10 Gm., adeps benz. 90.

2. *Plumbi Oxidum Rubrum. Red Lead,* Pb_3O_4, *N.F.*—Obtained by heating massicot to 450° C. (840° F.), which gradually combines with more oxygen, forming red lead oxide. It is a heavy, orange-red powder, odorless, tasteless, slowly absorbs moisture and carbon dioxide; almost insoluble in water, insoluble in alcohol, soluble in excess of glacial acetic acid; also lactic acid with evolution of carbon dioxide and the odor of acetaldehyde. When heated in crucible—changes to red, violet, then blackish, regaining original color on cooling, but if heat continued slowly decomposes forming lead monoxide and oxygen; heated with charcoal—metallic lead; contains lead orthoplumbate, Pb_2PbO_4, usually with some unconverted lead oxide, PbO, corresponding to 30 p. c. of lead dioxide, PbO_2. *Impurities:* Iron, copper, carbonate, sulphate, lead sulphate, silicate, soluble substances. Coloring flint glass, glazing, painting, cementing glass, gas and steam pipes, matches, pencils for writing on glass, oxidizing agent in chemistry—Poisonous: 1. *Emplastrum Fuscum Camphoratum,* Camphorated (Brown) Mother Plaster, 30 p. c., plumb. oxid. rub. 30 Gm., ol. oliv. 60, cera flav. 15, camphor 1. 2. *Unguentum Fuscum,* Brown Ointment, Mother's Salve—emp. fusc. camph. 50 Gm., ol. oliv. 25, sevum præp. 25.

3. *Plumbi Carbonas. Lead Carbonate,* $(PbCO_3)_2,Pb(OH)_2$, U.S.P. 1820–1890.—Obtained by exposing lead sheets to air, acetic acid vapors, and carbon dioxide—$6Pb + 6HC_2H_3O_2 + O_6 + 2CO_2 = (PbCO_3)_2,Pb(OH)_2 + 2H_2O + 3Pb(C_2H_3O_2)_2$, or by double decomposition between lead nitrate and sodium carbonate. It is a heavy white opaque powder or pulverulent mass, odorless, tasteless, per-

manent, insoluble in water, alcohol, soluble in acetic acid or diluted HNO_3 with effervescence; heated with charcoal—reduces it to metallic lead. Used externally as a protective to irritated surfaces, also to constringe; erysipelas, erythema, intertrigo, ulcers, excoriated surfaces, eczema, burns, carbuncles; as paint, cosmetic; often produces chronic poisoning when applied to abraded parts; usually applied in fine powder or ointment (10 p. c.).

4. *Plumbi Nitras. Lead Nitrate*, $Pb(NO_3)_2$, U.S.P. 1850–1900.—Obtained by neutralizing warm dilute nitric acid with lead oxide or carbonate, crystallizing in a cool place—$PbO + 2HNO_3 = Pb(NO_3)_2 + H_2O$. It is in colorless, transparent or opaque octahedral crystals, odorless, sweetish, astringent, metallic taste, permanent, soluble in water (1.85), insoluble in alcohol (thus differing from acetate), ignites to oxide; contains 99.5 p. c. of pure salt. *Impurities:* Iron, copper, zinc, salts of alkalies, magnesium, calcium, etc. Discutient, deodorizer—externally; to correct fetor of gangrenous sores, discharges from ear, nostril (ozena), rectum, vagina; sore nipples, chapped hands, cracked lips, leucorrhea, gonorrhea, ulcers, impetigo, epithelioma; Ledoyen's disinfecting fluid (12 p. c.) valuable deodorant. Dose, gr. $\frac{1}{2}$–4 (.03–.26 Gm.).

CUPRUM. COPPER.

$Cu^{ii} = 63.57$.

The element copper (Gr. κύπρος, Cyprus, Mediterranean island, whence the Romans got their best copper; L. *cuper*, *cuprum*, contr. of Cyprium), U.S.P. 1820, 1830, 1870, enters into alloys—brass, German silver, bell-metal, bronze, gun-metal, to harden gold, silver, and occurs in nature as metal, sulphide, oxide, sulphate, carbonate, phosphate, and arsenate. The most common ore—copper pyrites, Cu_2S,-Fe_2S_3, has brass or gold luster, but copper glance, Cu_2S (dark gray), and malachite, $Cu_2CO_3.Cu(OH)_2$ (beautiful green), yield considerable metal. Copper is red in color, malleable, sp. gr. 8.92–8.95, good conductor of heat and electricity, by exposure becoming coated with green film of subcarbonate; forms two oxides: 1. Red—*cuprous*, Cu_2O; 2. Black—*cupric*, CuO.

Tests for Copper Salts: 1. H_2S or NH_4SH precipitates black cupric sulphide. 2. KOH or NaOH precipitates blue cupric hydroxide, $Cu(OH)_2$, which by boiling becomes (black) cupric oxide, CuO; but with NH_4OH get only dark blue solution –an ammonio-copper compound. 3. Potassium ferrocyanide precipitates reddish-brown cupric ferrocyanide, $Cu_2Fe(CN)_6$. 4. Polished iron, steel, or zinc immersed in an acidified copper solution becomes coated with metallic copper.

Cupri Sulphas. Cupric Sulphate, $CuSO_4.5H_2O$, *U.S.P.*—(Syn., Cupr. Sulph., Copper Sulphate, Blue Vitriol, Blue-stone, Roman Vitriol, Cuprum Vitriolatum, Sulfas Cupricus; Fr. Sulfate de Cuivre, Vitriol bleu, Couperouse bleu; Ger. Cuprum sulfuricum, Kupfer-(vitriol)-sulfat, Blauer (vitriol) Galitzenstein, Schwefelsaures Kupfer.)

Manufacture: Heat copper with sulphuric acid, shake with hot water, evaporate, crystallize—$Cu + 2H_2SO_4 = CuSO_4 + 2H_2O + SO_2$, or may heat copper pyrites. It is in deep blue, triclinic crystals, blue granular powder, odorless, nauseous, metallic taste, slowly efflorescent, soluble in water (2.5), boiling water (.5), alcohol (500), glycerin (2.8); aqueous solution (1 in 20) blue, acid; contains 63 66.8 p. c. of anhydrous copper sulphate, corresponding to 98.5 p. c. of the crystallized salt. *Tests:* 1. Heat to 30° C. (86° F.) loses part of water of crystallization, becoming a pale blue, amorphous powder; at 100° C. (212° F.) loses more water, at 200° C. (392° F.) a white anhydrous powder remains, and at higher heat sulphur dioxide and oxygen are given off, leaving a residue of black cupric oxide. 2. Aqueous solution 1 drop on bright iron—red film deposits (metallic copper). 3. Aqueous solution, + barium chloride T. S.—white precipitate, insoluble in hydrochloric acid. *Impurities:* Other metals, especially iron. Should

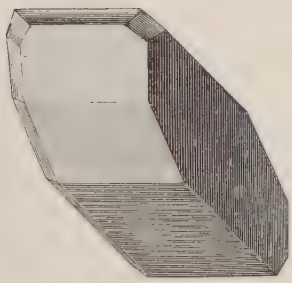


Fig. 465.—Copper sulphate crystal.

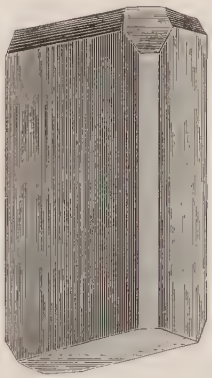


Fig. 466.—Copper acetate crystal.

be kept in well-closed containers. Dose, tonic, astringent, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), in pill; emetic, gr. 2–10 (.13–.6 Gm.), mixed with sugar or in solution, repeated in 15 minutes if necessary.

Preparation.—1. *Mistura Adstringens, N.F.*, 6.5 p. c.

Properties and Uses.—Astringent, tonic, irritant, escharotic, emetic, stimulant. Once used for epilepsy, and now for chronic ulcerative diarrhea, dysentery, cholera, croup, malignant sore throat. Externally—foul ulcers, caustic for warts, fungoids, callous, bleeding surfaces, chancres, ulcerative stomatitis, gangrene of pharynx, mercurial sore mouth, conjunctivitis, acne, eczema. Convenient forms for application are the crystal, cuprum aluminatum (*lapis divinus, pierre divine, pierre ophthalmique*, in pencils or stick), and the wash ($\frac{1}{2}$–1–2 p. c.). Used also as a test for diabetic sugar, and in making many green pigments, as Scheele's green (arsenite), Paris green (aceto-arsenite), Bremen green (hydroxide), and others.

Poisoning: Large doses gastro-intestinal irritant; long-continued small doses cause bronchial catarrh, colic, vomiting, diarrhea (bloody, mucous), tenesmus, salivation, anemia, wasting, jaundice, fatty liver, nervousness, thirst, hurried respiration, delirium, small, rapid pulse, convulsions, coma. Give egg-white to form insoluble compound, then emetics at once, also reduced iron, weak solution potassium ferrocyanide (chemical antidote), magnesium oxide, tannin, opium, again empty stomach and saturate system with potassium iodide, heat, stimulants.

Incompatibles: Alkalies, their carbonates, sulphides, mineral salts (except sulphates), lime water, iodides, vegetable astringents.

Allied Salts:

1. *Cupri Acetas. Copper Acetate*, $Cu(C_2H_3O_2)_2.H_2O$, U.S.P. 1830-1880.—Obtained by dissolving verdigris in acetic acid, or precipitate solution of lead acetate with copper sulphate. It is in deep bluish-green rhombic prismatic crystals, efflorescent, odorless, nauseating metallic taste, soluble in water (15), alcohol (135). *Impurities:* Alkalies, alkaline earths, iron, lead, zinc, chloride, sulphate, calcium. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.). Solutions should be $\frac{1}{5}$–1 p. c.

Properties and Uses.—Skin diseases, scrofula, intermittents, epilepsy, in collyria, aphthous ulcers, gonorrhea.

2. *Cupri Subacetas. Copper Subacetate. Verdigris*, $Cu_2O(C_2H_3O_2)_2$, U.S.P. 1820–1870.—Obtained by subjecting grape husks to acetic fermentation, then stratifying them in earthen vessels with sheets of copper for 4–6 weeks, when the sheets upon drying and exposing to air for several weeks are coated with verdigris, which is scraped off and the plates replaced for a second action, etc.; the verdigris is dried in the sun, and occurs in masses, having bluish-green color, composed of many silky crystals, coppery taste, insoluble in alcohol, soluble in ammonia, HCl, diluted H_2SO_4, partially in water.

Properties and Uses.—Stimulant, escharotic; externally—indolent ulcers, tuberculated skin affections, warts, chancres. Not used internally.

3. *Cuprum Ammoniatum. Ammoniated Copper*, $Cu(NH_3)_4SO_4,H_2O$. —Obtained by rubbing together copper sulphate 4, ammonium carbonate 3, until effervescence ceases, drying. Deep azure-blue color, ammoniacal odor. Epilepsy, chorea. Dose, gr. $\frac{1}{2}$–1 (.03 .06 Gm.). *Copper Arsenite* (Scheele's green) may be employed in cholera infantum, diarrhea.

BISMUTHUM. BISMUTH.

$Bi^{iii} = 209.$

The element bismuth (Ger. *wismut*, fr. *wiesematte*, a beautiful shadow, from its variegated tints when fresh), U.S.P. 1820–1870, is found mostly in metallic state as small veins in rocks, occurs also as sulphide; it is obtained from the ore by heating until sufficiently mobile to separate from its earthy matter, Bismuth is brittle, crystalline,

brilliant, with silver color and pinkish tinge, forms several alloys and many medicinal salts, some being official.

Tests for Bismuth Salts.—1. H_2S or NH_4SH precipitates blackish-brown bismuth sulphide, Bi_2S_3, insoluble in excess. 2. Acid bismuth solutions poured into water form white precipitate of subsalts or bismuthyl salts. 3. Ammonium or sodium hydroxide or carbonate precipitates white bismuth hydroxide, $Bi(OH)_3$, or bismuthyl carbonate.

Bismuthi Subnitras. Bismuth Subnitrate, $BiONO_3H_2O$ (?), *U.S.P.*—(Syn., Bism. Subnit., Basic Bismuth Nitrate, White Bismuth, Bismuthum Hydrico-nitricum, Magisterium Bismuthi, Subazotas (Subnitras) Bismuthicus, Bismuthyl Nitrate; Br. Bismuth Oxynitrate; Fr. Sous-azotate (Sous-nitrate) de Bismuth; Ger. Bismutum subnitricum, Basisches Wismutnitrate (Salpetersaures Wismutoxyd), Wismutsubnitrat.)

Manufacture: Dissolve purified bismuth (1) in nitric acid (5), heated to 90° C. (194° F.), let stand several days, decant, evaporate to crystallization; rub uniformly crystals (1) with water (4) and pour while stirring into boiling water (21), drain, wash, dry—$Bi_2 + 8HNO_3 = 2Bi(NO_3)_3 + 2NO + 4H_2O$; $6Bi(NO_3)_3 + 10H_2O = 5BiONO_3,H_2O + Bi(NO_3)_3 + 10HNO_3$. It is a white powder, odorless, almost tasteless, slightly hygroscopic, practically insoluble in water, insoluble in alcohol, readily soluble in hydrochloric or nitric acid, slightly acid; composition somewhat varying; contains, upon ignition, 79 p. c. of bismuth oxide (Bi_2O_3). *Tests:* 1. Dissolve in slight excess of warm nitric or hydrochloric acid and add to 25 volumes of distilled water—white turbidity. 2. Heat to redness—evolves brown vapors of nitrogen oxides, leaving yellow residue. *Impurities:* Arsenic, copper, iron, zinc, lead, silver, alkalies, alkali earths, carbonate, chloride, sulphate, insoluble foreign salts. Should be kept dark. Dose, gr. 5–30 (.3–2 Gm.), ter die, in water on empty stomach.

Preparations.—1. *Glyceritum Bismuthi, N.F.*, 18 p. c., bism. subnit. 18 Gm., acid. nitric. 16 cc., acid. tart. 23.8 Gm., sod. bicarb. 33.4, glycerin 47.5, aq. dest. q. s. 100 cc. 2. *Magma Bismuthi*, Milk of Bismuth, *N.F.*, 8 p. c., bism. subnit. 8 Gm., acid. nitric. 12 cc., ammon. carb. 1 Gm., aq. ammon., to precipitate and make alkaline (48 cc.), aq. dest. for double decomposition (1000 cc.), and q. s. 100 cc. Dose, ʒj–2 (4–8 cc.). 3. *Unguentum Resorcinolis Compositum, N.F.*, 6 p. c.

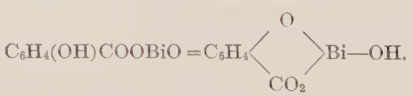
Properties and Uses.—Sedative, astringent, almost insoluble in the system, acts mechanically by coating the gastric mucous membrane with a protective film, thus preventing irritation from contents. Used in diseases of the stomach—gastralgia, subacute gastritis, pyrosis, irritated intestinal mucous membrane, diarrhea, dysentery, cholera infantum; injection in gonorrhea, leucorrhea, dysentery, rectal irritation, coryza; the powder locally in burns, variola, eczema, fissures, chapped nipples, lips, hands, intertrigo, ozena, fetid feet, whooping-cough; also a test for diabetic sugar.

Bismuthi Subcarbonas. Bismuth Subcarbonate, $(BiO)_2CO_3,H_2O(?)$ *U.S.P.*—(Syn., Bism. Subcarb., Basic Bismuth Carbonate, Bismuth Oxycarbonate, Pearl White, Bismuthum Subcarbonicum, Subcarbonas Bismuthicus, Bismuthyl Carbonate; Br. Bismuthi Carbonas, Bismuth Oxycarbonate; Fr. Sous-carbonate de Bismuth; Ger. Basisches (Wismutkarbonat, Kohlensaures Wismutoxyd), Wismutsubcarbonat.)

Manufacture: Dissolve purified bismuth in nitric acid diluted, filter, add ammonia water, wash and dissolve precipitate in nitric acid, pour this into cold solution of sodium carbonate, constantly stirring, filter, wash and dry precipitate—(1) $Bi + 4HNO_3 = Bi(NO_3)_3 + NO + 2H_2O$. (2) $2Bi(NO_3)_3 + 3Na_2CO_3 + H_2O = (BiO)_2CO_3,H_2O + 6NaNO_3 + 2CO_2$. It is a white, pale yellowish-white powder, odorless, tasteless, permanent, insoluble in water, alcohol, completely soluble in nitric or hydrochloric acid with copious effervescence; composition somewhat varying; contains, upon ignition, 90 p. c. of bismuth oxide (Bi_2O_3). *Tests:* 1. Dissolve 3 Gm. in warm nitric acid (about 4 cc.), pour this into distilled water 100 cc.—white precipitate; filter, evaporate on water-bath to 30 cc.—solution for various tests. 2. Heat to redness—loses water and carbon dioxide, leaving yellowish residue soluble in nitric or hydrochloric acid and blackened by hydrogen sulphide T. S. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, chloride, nitrate, sulphate. Dose, gr. 5–30 (.3–2 Gm.).

Properties and Uses.—Intended as a substitute for subnitrate, as it is a little more soluble, hence less likely to constipate and blacken the stools; but as these are disadvantages, it is not much used.

Bismuthi Subsalicylas. Bismuth Subsalicylate, *U.S.P.*—(Syn., Bism. Subsalicyl.; Basic Bismuth Salicylate, Bismuth Oxysalicylate; Br. Bismuthi Salicylas; Fr. Sous-salicylate de Bismuth; Ger. Bismutum subsalicylicum, Basisches Wismutsalicylat.)

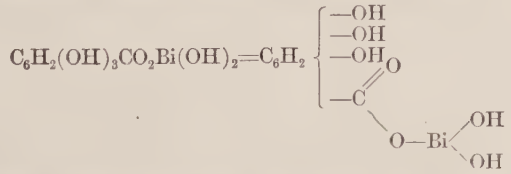


Manufacture: Digest for 2 days in a warm place, frequently stirring, bismuth subnitrate (500), distilled water (1000), add strong ammonia water (50), wash precipitate (Bi_2O_3), and while moist add a little distilled water and salicylic acid (125), let stand 24 hours, frequently stirring, wash precipitate, dry. It is a white, nearly white, amorphous or crystalline powder, odorless, tasteless, permanent, practically insoluble in water but when boiled in it a portion of the salicylic acid is dissolved with the formation of a more basic bismuth subsalicylate; partly soluble, with decomposition, in hydrochloric or nitric acid—white flocculent precipitate of salicylic acid separating; composition somewhat varying; contains, upon ignition, 62–66 p. c. of bismuth oxide (Bi_2O_3). *Tests:* 1. Heat to redness—chars, above 300° C. (572° F.)—residue yellow, blackened by hydrogen sulphide, which dissolved in slight

excess of warm nitric or hydrochloric acid and added to 25 volumes of distilled water—white turbidity. 2. Agitate .1 Gm. with a solution of 5 drops of ferric chloride T. S. in 10 cc. of distilled water—deep violet-blue. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, nitrate, sulphate, free salicylic acid. Should be kept dark. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Internal antiseptic, astringent; passes through stomach unchanged, but is decomposed in small intestine, where it acts as an unirritating antiseptic. Diarrhea, typhoid, catarrh of alimentary tract, mucous membrane inflammation, gastric disorders; externally like iodoform—wounds, etc.

Bismuthi Subgallas. Bismuth Subgallate, *U.S.P.*—(Syn., Bism. Subgal., Basic Bismuth Gallate, Bismuth Oxygallate, Dermatol, Bismuthyl Gallate; Fr. Sous-gallate de Bismuth; Ger. Bismutum subgallicum, Basisches Wismutgallat, Wismutsubgallat.)



Manufacture: Dissolve bismuth trinitrate (15) in glacial acetic acid (30), add water (250) to filtrate, constantly stirring, add warm aqueous solution of gallic acid (5 in 250), wash precipitate by decantation until free from nitric acid, dry. It is an amorphous, bright yellow powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, readily soluble with decomposition in warm, moderately dilute, hydrochloric, nitric, or sulphuric acid, insoluble in very dilute mineral acids, soluble in alkali hydroxide solutions clear, yellowish, rapidly changing to deep red; composition somewhat varying; contains, upon ignition, 52–57 p. c. of bismuth oxide. *Tests:* 1. Heat to redness—chars, residue yellow, blackened by hydrogen sulphide T. S., which dissolved in slight excess of warm nitric or hydrochloric acid and added to 25 volumes of distilled water—white turbidity. 2. Agitate .1 Gm. with excess of hydrogen sulphide T. S.—brownish-black precipitate, boil filtrate to remove dissolved gas, cool, + a drop of ferric chloride T. S.—blue-black. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, nitrate, free gallic acid. Dose, gr. 5–30 (.3–2 Gm.).

Properties and Uses.—Antiseptic. Like iodoform, but has sedative, astringent, drying, and antibacterial effects upon wounds, ulcers, eczemas; fermentative dyspepsia, diarrhea of tuberculosis and typhoid fever; apply in powder, ointment (1 + 10 vaseline), gauze (10 p. c.).

Incompatibles: Acids.

Allied Salts:

1. *Bismuthi Betanaphtholas. Bismuth Betanaphthol,* $C_{10}H_7O.Bi_2O_2(OH)$, U.S.P. 1910.—Obtained by acting upon bismuth trinitrate

dissolved in dilute glycerin or acid with alkaline solution of betanaphthol. It is a buff, grayish-brown amorphous powder, odorless, faint odor of betanaphthol, tasteless, permanent, nearly insoluble in water, alcohol, chloroform, ether, partially in mineral acids forming corresponding bismuth salts and liberating betanaphthol; composition somewhat varying; should contain 15 p. c. of betanaphthol, and, upon ignition, 73–78 p. c. of bismuth oxide. Heat strongly—chars, residue grayish-yellow, blackened by hydrogen sulphide T. S. Shake 1 Gm. with chloroform (20 cc.), evaporate filtrate spontaneously, dry in desiccator—residue 1 p. c. (abs. of free betanaphthol). *Impurities:* Free betanaphthol, arsenic, copper, lead, silver, chloride, nitrate, sulphate. Decomposed in the duodenum into naphthol and bismuth hydroxide, when each exerts its own effects. Intestinal astringent, antiseptic, substitute for iodoform—diarrhea, dysentery, cholera infantum, gastro-intestinal catarrh (gastritis), enteritis, dyspepsia, ulcers, mucous inflammations, impetigo; should not be mixed with acacia which forms viscid preparations rapidly hardening. Dose, gr. 5–8 (.3–.5 Gm.), 5–6 times daily; children gr. 1–5 (.06–.3 Gm.).

2. *Bismuthi et Ammonii Citras. Bismuth and Ammonium Citrate*, $BiC_6H_5O_7,NH_4OH,2H_2O(?)$, U.S.P. 1880-1910.—Obtained by rubbing to a paste bismuth citrate 100 Gm. with distilled water 200 cc., heat gradually, add ammonia water until salt dissolved and liquid neutral, filter, evaporate to syrupy consistence, spread upon glass plates so as to dry in scales. It is in shining, pearly or translucent scales, odorless, metallic taste, opaque on exposure with loss of ammonia, soluble in water, sparingly in alcohol, fuses leaving blackened residue with yellow surface, which dissolved in nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water; aqueous solution (1 in 20) neutral, faintly acid; contains, upon ignition, 46–52 p. c. of bismuth oxide. Boil with slight excess of sodium hydroxide T. S.—evolves ammonia. Aqueous solution + excess of hydrogen sulphide—brownish-black precipitate; filtrate deprived by heat of excess of hydrogen sulphide and boiled with excess of lime water—white precipitate. *Impurities:* Arsenic, copper, lead, silver, alkalies, alkali earths, chloride, nitrate, sulphate. Differs from the insoluble bismuth salts in being more astringent and irritating; employed in chronic serous diarrhea due to relaxed condition of the intestinal mucous membrane, but never where acute inflammation or irritation exists; not nearly so valuable as the insoluble salts. Should be kept dark, in well-closed containers. Dose, gr. 1–4 (.06–.26 Gm.); *Liquor Bismuthi et Ammonii Citratis* (Br.), 7 p. c., ʒss–1 (2–4 cc.).

3. *Bismuthi Citras. Bismuth Citrate*, $BiC_6H_5O_7$, U.S.P. 1880–1900.—Obtained by heating on a water-bath bismuth subnitrate 100 Gm., citric acid 75 Gm., distilled water 400 cc., frequently stirring, until a drop is clear in ammonia water, adding distilled water 5000 cc., washing, drying precipitate—$(BiONO_3 + H_2O) + H_3C_6H_5O_7 + H_2O) = BiC_6H_5O_7 + HNO_3 + 3H_2O$. It is a white amorphous or crystalline

powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in ammonia water and alkaline citrate solutions; should yield 58–60 p. c. of pure bismuth oxide. Astringent, irritant, similar to subnitrate; important only as the base of bismuth and ammonium, citrate, U.S.P. 1880–1910. *Impurities:* Lead, copper, silver, arsenic, chlorides, sulphates, nitrate, etc. Dose, gr. 1–3 (.06–.2 Gm.).

4. *Bismuthi Oxidum. Bismuth Oxide,* Bi_2O_3.—Obtained by boiling for 5 minutes, bismuth subnitrate in solution of sodium hydroxide, filtering, drying precipitate—$2(BiONO_3,H_2O) + 2NaOH) = 2Bi(OH)_3$ or $(Bi_2O_3,3H_2O) + 2NaNO_3$). Occurs as a dull lemon-yellow powder, resembling the subnitrate in medicinal properties, doses, and uses.

ARGENTUM. SILVER.

$Ag^i = 107.88$.

The element silver (AS. *seolfer;* L. *argentum;* Gr. ἄργυρος, white —*i. e.*, its bright, shining color), U.S.P. 1820–1870, occurs natively as metal and sulphide; the latter, being along with lead sulphide—argentiferous galena—is simply roasted, when lead oxidizes into litharge and pure silver separates. Silver may also be obtained by amalgamation—dissolving it in mercury and distilling the amalgam, when mercury, being volatile, passes over, and silver remains. It is the whitest metal, best conductor of heat and electricity, takes brilliant polish, malleable, ductile, sp. gr. 10.4–10.5.

Tests for Silver Salts: 1. H_2S or NH_4SH precipitates black silver sulphide, Ag_2S. 2. Hydrochloric acid, or any soluble chloride, precipitates white curdy silver chloride, AgCl, insoluble in hot HNO_3, but soluble in ammonia water. 3. Alkaline hydroxides precipitate brown silver oxide, Ag_2O, soluble in ammonia water. 4. Metallic copper, zinc, or iron precipitates metallic silver.

Argenti Nitras. Silver Nitrate, $AgNO_3$, *U.S.P.*—(Syn., Arg. Nit., Lunar Caustic; Fr. Azotas (Nitras) Argenticus, Azotate (Nitrate) d'Argent, Nitre lunaire; Ger. Argentum nitricum (Crystallizatum), Silbernitrat, Salpetersaures Silberoxyd, Silbersalpeter.)

Manufacture: Dissolve silver in nitric acid by heat, evaporate to dryness to expel free acid, dissolve dry mass in hot water, crystallize —$3Ag + 4HNO_3 = 3AgNO_3 + NO + 2H_2O$. It is in colorless, transparent, tabular, rhombic crystals, gray or grayish-black on exposure to light in presence of organic matter, odorless, bitter, caustic, strongly metallic taste, soluble in water (.4), boiling water (.1), alcohol (30), boiling alcohol (6.5), slightly soluble in ether, melts at 200° C. (392° F.) into yellowish liquid which on cooling congeals into pure white crystalline mass, gradually decomposes at higher temperature with evolution of nitrogen oxides; aqueous solution clear, colorless, neutral; contains 99.8 p. c. of pure salt. *Tests:* 1. Aqueous solution + hydrochloric acid—white curdy precipitate, insoluble in nitric acid,

readily soluble in ammonia water. 2. Aqueous solution (1 in 10) in test-tube, + a drop of diphenylamine T. S. then carefully superimpose it upon sulphuric acid to form separate layer—deep blue at line of contact. *Impurities:* Copper, etc. Should be kept dark, in dark amber-colored, glass-stoppered vials. Dose, gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.), ter die, in pill with bitter extracts, but not with bread containing salt, as this hastens decomposition; best given on empty stomach.

Preparation.—1. *Argenti Nitras Fusus.* Fused Silver Nitrate. (Syn., Arg. Nit. Fus., Moulded Silver Nitrate, Lunar Caustic, Lapis Infernalis; Br. Argenti Nitras Induratus, Toughened Caustic; Fr. Azotas (Nitras) Argenticus Fusus, Azotate (Nitrate) d'Argent fondu, Pierre infernale; Ger. Argentum nitricum (fusum), Gehärteter Höllenstein, Geschmolzenes Saltpetersaures Silberoxyd.)

Manufacture: Add hydrochloric acid 4 Gm. to silver nitrate 100 Gm., melt, stir, mold. It is a white hard solid, generally in pencils or cones, fibrous fracture, gray, grayish-black on exposure to light, odorless, bitter, caustic, strongly metallic taste; contains 94.5 p. c. of pure salt. *Tests* and *Impurities:* Same as for argenti nitras. The hydrochloric acid forms some silver chloride (5 p. c.) that toughens the compound, permitting more readily handling without breaking. Should be kept dark, in dark amber-colored, glass-stoppered vials.

Properties and Uses.—Alterative, stimulant, astringent, (only externally), hemostatic, escharotic (but does not act deeply), sedative, epilepsy, chronic spinal inflammation, locomotor ataxia, spasmodic tabes, ulcerations of alimentary tract, subacute gastritis, pyrosis, ulcer of stomach, chronic diarrhea, catarrh of the gall-ducts, typhoid fever, neuralgia, dysentery, cholera, vomiting of pregnancy, chronic jaundice, abnormal heart-action, bronchitis. Externally—diphtheritic exudations, croup (10 p. c.), chronic ulceration, simple inflammation, chronic laryngitis (1–5 p. c.), aphonia, whooping-cough, sore throat of speakers, tubercular and syphilitic tonsillitis, enlarged lymphatic glands, abscesses, iritis, sciatica, conjunctivitis ($\frac{1}{2}$–1 p. c.), corneal ulcers, hemorrhages from leech-bites, bed-sores, poisoned and other wounds, mercurial sore mouth, chancre, smallpox, herpes, intertrigo, burns, erysipelas, gonorrhea, leucorrhea, otorrhea, neck of bladder inflammation, vesical catarrh, urethral strictures, involuntary seminal emissions, enlarged prostate, corns, rectal ascarides.

Also much used in making indelible ink, dyes for hair, beard, etc. When used on the hair for a long time the system usually absorbs sufficient to produce poisonous symptoms, with permanent constitutional weakness. The stains may be removed by applying a solution of potassium cyanide, or potassium iodide, or tincture iodine + ammonia.

Poisoning: Have intense abdominal pain, muscular spasms, vomiting, purging, face livid, skin moist, black vomit containing coagulated mucus, coma, convulsions, paralysis, respiratory disturbance; when chronic have skin, conjunctivæ, and labial mucous membrane of a permanent slaty color, gastric ulceration. Administer weak draught

of sodium chloride (to decompose the nitrate), egg-white, milk, tannin, followed by emetic, opium for pain, sodium thiosulphate baths, stimulants—alcohol, strychnine, atropine, etc.; *chronic silver poisoning, argyria*, which gives slate-blue color to skin, livid cadaveric appearance, is usually not curable but palliated by potassium iodide.

Incompatibles: Alkalies, carbonates, chlorides, hydrochloric acid, tannin, potassium iodide, arsenic solution.

Synergists: Copper, lead, zinc.

Argento-Proteinum Forte. Strong Silver-Protein, *U.S.P.*—(Syn., Arg.-Prot. Fort., Strong Protargin, Protargolum, Protargol; Fr. Argent. proteinique; Ger. Albumosessilber, Proteinsilber.)

Manufacture: Treat protein bodies with a silver salt, and render soluble, this insoluble compound, by a solution of albumoses. It is a brown odorless powder, usually somewhat hygroscopic, freely soluble in water, almost insoluble in alcohol, chloroform, ether; contains 7.5–8.5 p. c. silver (Ag). *Tests:* 1. Residue from .2 Gm. by ignition + nitric acid 1 cc. + 10 cc. distilled water, + hydrochloric acid—white precipitate, soluble in ammonia T. S. 2. Aqueous solution (1–100) 10 cc. + 2 cc. solution of sodium chloride (1 p. c.)—no turbidity. 3. Aqueous solution (1–100) + ferric chloride T. S.—discharges the color and gradually produces a precipitate; + mercuric chloride T. S.—white precipitate, supernatant liquid colorless or nearly so. The silver is not precipitated by ordinary reagents. Should be kept dark in well closed containers; solutions should be freshly prepared and dispensed in amber-colored bottles.

Properties and Uses.—Germicide, antiseptic, non-irritant, disinfectant; one-third to one-half the bactericidal power of phenol; mucous membrane infections, gonorrhea, conjunctivitis, cystitis, urethritis, eye, ear, nose, throat; acute coryza, tonsillitis (10 p. c. solution), conjunctivitis, urethritis (1–2 p. c. solutions), gonorrhea (acute) injection ¼–1 p. c., (chronic) 5–10 p. c., irrigation (1 in 1000–2000), bougies, tampons (3–10 p. c.). Argyria of eyelids may result from use, when discoloration may be removed by methenamine.

Incompatibles: Strong mineral acids, heavy metals, iron, mercury, etc.

Argento-Proteinum Mite. Mild Silver-Protein, *U.S.P.*—(Syn., Arg.-Prot. Mit., Mild Protargin, Argyrol, Silver Vitellin).

Manufacture.—Obtained by extracting and purifying one of the wheat proteins, gliadin (similar to vitellin), and heating it 3 hours under pressure in an autoclave with diluted hydrochloric acid; to a concentrated solution of this add strong solution silver nitrate, dry precipitate *in vacuo*. It occurs in dark brown, almost black shining scales, granules, odorless, frequently hygroscopic; freely soluble in water, nearly insoluble in alcohol, ether, chloroform; contains 19–25 p. c. silver (Ag.). *Tests:* 1. Similar to strong silver-protargin. Should be kept dark, in well-closed containers; solutions for use should be

freshly prepared and dispensed in amber-colored bottles. Used locally in acute inflammations in 5–10–20–50 p. c. solutions — gonorrhea (5 p. c.), chronic urethritis (5–10 p. c.), cystitis (10 p. c.), purulent conjunctivitis (25–50 p. c.), rhinitis, pharyngitis, laryngitis, vaginitis, dysentery; internally, gastric ulcer, gastritis, gastro-enteritis. Dose, gr. 5–10 (.3–.6 Gm.)—seldom given internally.

Allied Salts:

1. *Argenti Oxidum. Silver Oxide,* Ag_2O, U.S.P. 1850–1910.—Obtained by shaking silver nitrate solution with liquor potassii hydroxidi, washing precipitate—$2AgNO_3 + 2KOH = Ag_2O + 2KNO_3 + H_2O$. It is a heavy, brownish-black powder, easily reduced by exposure to light, odorless, metallic taste, slightly soluble in water with alkalinity, insoluble in alcohol, soluble in nitric acid; decomposes at 300° C. (572° F.), liberating oxygen, with residue of metallic silver; contains 99.6 p. c. of pure salt. *Impurities:* Copper, chloride. Similar to silver nitrate, but much weaker. Slight caustic, sedative; nausea, cardialgia, pyrosis, pains in the stomach, dysentery, diarrhea, night-sweats, dysmenorrhea, menorrhagia, leucorrhea, dilated uterus with flooding, tenia, venereal sores, gonorrhea, hemorrhages, gastric ulcers, dyspepsia, catarrhal affections, colors skin somewhat. Should be kept in well-stoppered, dark amber-colored vials, and must not be triturated with readily oxidizable or combustible substances, nor brought in contact with ammonia. Dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.), ter die, in pill; externally, ointment (10–20 p. c.).

2. *Argenti Cyanidum. Silver Cyanide,* AgCN, U.S.P. 1840–1900.—Obtained by distilling potassium ferrocyanide, sulphuric acid and water together, passing the evolved gas, HCN, into an aqueous solution of silver nitrate, washing, drying the precipitate—$AgNO_3 + HCN = AgCN + HNO_3$; or add solution of silver nitrate to a solution of potassium cyanide until precipitation ceases, filter, wash well—$AgNO_3 + KCN = AgCN + KNO_3$. It is a white powder, odorless, tasteless, permanent in dry air, brownish on exposure to light, insoluble in water, alcohol, cold nitric acid, soluble in boiling nitric acid, ammonia water, sodium thiosulphate T. S., potassium cyanide T. S., fused gives off cyanogen gas, leaving residue of metallic silver (80.48 p. c.); contains 99.9 p. c. of pure salt, corresponding to 80.48 p. c. of metallic silver. Should be kept dark, in dark amber-colored bottles. Rarely used in medicine but in preparing diluted hydrocyanic acid. Dose, gr. $\frac{1}{60}$–$\frac{1}{20}$ (.001–.003 Gm.).

3. *Argenti Iodidum. Silver Iodide,* AgI, U.S.P. 1880–1890.—Obtained by double decomposition between silver nitrate and potassium iodide, washing and drying the precipitate—$AgNO_3 + KI = AgI + KNO_3$. It is a heavy, amorphous, yellow powder, unaltered by light; if impure becomes greenish-yellow, odorless, tasteless, insoluble in water, alcohol, diluted acids, soluble in solution of potassium cyanide. *Impurities:* Chloride, bromide. Should be kept in the dark, in amber-colored vials. Dose, gr. $\frac{1}{4}$–2 (.016–.13 Gm.), ter die, in pill.

Similar to silver nitrate, and from its not coloring the skin, once was believed a better salt, but not now so considered; used in syphilis, visceral neuralgia, asthma, chorea, whooping-cough.

4. *Argenti Nitras Mitigatus. Mitigated Silver Nitrate. Diluted Silver Nitrate*, U.S.P. 1870–1910.—Obtained by melting together at low temperature in porcelain crucible silver nitrate 30 Gm. and potassium nitrate 60 Gm., stirring until it flows smoothly, pouring into molds. Should be kept dark, in dark amber-colored bottles. Used when mild action desired.

HYDRARGYRUM. MERCURY, *U.S.P.*

$Hg^{ii} = 200.6$.

(Syn., Hydrarg., Quicksilver, Hydrargyrum Vivum, Mercurius Vivus, Argentum Vivum; Fr. Mercure, Vif Argent; Ger. Quecksilber.)

The element mercury (after the messenger of the gods, from its mobility, quicksilver, similar origin; L. *hydrargyrum;* Gr. ὕδωρ, water, + ἄργυρος, whiteness, luster) is found as globules in the metallic state and as mercuric sulphide, cinnabar, in mines of Spain, Austria, California, Peru, Japan, Mexico. The metal is obtained by roasting cinnabar in the air, which dissipates SO_2, and leaves Hg behind; or may distil it with lime, which combines with the sulphur, and the mercury, being volatile, is conveyed into cooling chambers, where it condenses. It is a shining, silver-white metal, liquid at ordinary temperatures, easily divisible into spherical globules; at —40° C. (—40° F.) forms a ductile, malleable mass; odorless; tasteless; sp. gr. 13.5; insoluble in ordinary solvents, concentrated hydrochloric acid, sulphuric acid (dissolving in latter when boiled); soluble in nitric acid; contains 99.5 p. c. of pure mercury; forms 2 series of compounds: *mercuric* (Hg), *mercurous* (Hg_2). *Tests:* 1. At ordinary temperature—volatilizes slowly, more rapidly with increased heat; boils at 358° C. (677° F.), volatilizes with residue .02 p. c. 2. Dropped upon white paper—globules roll about freely, retain form, and leave no streaks or traces. 3. Must be dry, with bright surface even after agitation in contact with air.

Tests for Mercury Salts: 1. H_2S or NH_4SH precipitates black mercuric (and mercurous) sulphide. 2. KI precipitates green mercurous iodide and red mercuric iodide, soluble in excess. 3. Potassium, sodium, or calcium hydroxide precipitates brownish-black mercurous oxide (Hg_2O) and yellow mercuric oxide (HgO). 4. Ammonium hydroxide precipitates black mercurous ammonium salt and white mercuric ammonium salt. 5. Metallic copper placed in acid mercuric solution soon becomes coated with metallic mercury.

PREPARATIONS.—1. *Hydrargyrum cum Creta.* Mercury with Chalk. (Syn., Hydrarg. c. Cret., Gray Powder, Æthiop's Cretaceus; Fr. Mercure avec la Craie; Poudre de Mercure crayeux; Ger. Quecksilber mit Kreide.)

Manufacture: Shake by hand, or mechanically, mercury 38 Gm., honey 10, water 2 cc., in a strong bottle, until globules no longer visible under lens magnifying 4 diameters (10 hours); rub prepared chalk 57 Gm. with water q. s. for creamy paste, add contents of bottle, triturate to uniform mixture, dry to 100 Gm., pulverize. It is a light gray, rather damp powder, non-gritty, odorless, slightly sweet taste; contains 37–39 p. c. of mercury. *Tests:* 1. Digest .1 Gm. with warm acetic acid—chalk dissolves with effervescence, finely divided mercury remains. *Impurities:* Mercurous oxide, mercuric oxide. Should be kept dark, in well-closed containers, owing to ready oxidation of so finely divided mercury. Dose, gr. 5–10 (.3–.6 Gm.), twice daily; children, gr. $\frac{1}{6}$–3 (.01–.2 Gm.).

2. *Massa Hydrargyri.* Mass of Mercury. (Syn., Mass. Hydrarg., Blue Mass, Blue Pill, Massa Cœrulea, Pilulæ Cœruleæ; Br. Pilula Hydrargyri, Mercury Pill; Fr. Masse pilulaire bleue, Pilule de Mercure; Ger. Mercurial Pillen (masse).)

Manufacture: 33 p. c. Triturate oleate of mercury 1 Gm. in a warm mortar, gradually add mercury 33 Gm., and then gradually honey of rose 32 Gm., triturating until globules of mercury are no longer visible under a lens magnifying 10 diameters; add gradually glycerin 9, glycyrrhiza 10 and althea 15; triturate until mass homogeneous. Dose, gr. 3–15 (.2–1 Gm.).

Preps.: 1. *Pilulæ Aloes, Hydrargyri et Podophylli, N.F.,* 1 gr. (.06 Gm.). 2. *Pilulæ Digitalis, Scillæ et Hydrargyri, N.F.,* 1 gr. (.06 Gm.).

3. *Unguentum Hydrargyri Fortius.* Stronger Mercurial Ointment. (Syn., Ung. Hydrarg. Fort., Unguentum Hydrargyri, U.S.P. 1910, Blue Ointment, Unguentum (Mercuriale) Neapolitanicum; Br. Mercury Ointment; Fr. Pomatum cum Hydrargyro, Pommade (Onguent) Mercurielle à parties égales, Pommade napolitaine; Ger. Quecksilbersalbe.)

Manufacture: 50 p. c. Triturate oleate of mercury 2 Gm., in a warm mortar, with mercury 50 Gm., added gradually, until globules completely divided and distributed, set aside for 15 minutes; melt benzoinated lard 25 Gm., prepared suet 23 Gm., allow to cool partially, add 2.5 Gm. of it to the mercurial mixture, triturate until globules of mercury are no longer visible under a lens magnifying 10 diameters, then incorporate the remainder, mix thoroughly.

Prep.: 1. *Unguentum Hydrargyri Mite.* Mild Mercurial Ointment. (Syn., Ung. Hydrarg. Mit., Unguentum Hydrargyri Dilutum, U.S.P. 1910, Diluted Mercurial Ointment, Blue Ointment; Hydrargyri unguentum, P.I.; Fr. Onguent mercuriel dilué; Ger. Unguentum Hydrargyri Cinereum, Verdünnte Graue Quecksilbersalbe.)

Manufacture: 30 p. c. Mix thoroughly stronger mercurial ointment 60 Gm., petrolatum 20, ointment 20, proceeding as in the above.

4. *Unguentum Hydrargyri Nitratis. Citrine Ointment, N.F.* Melt in a porcelain dish lard 76 Gm., at 45° C. (113° F.), add nitric acid 7 Gm., at once, continue heat until characteristic reaction is complete, holding an inverted glass funnel over the dish to protect operator from spurting lard; withdraw heat immediately after rapid rise of froth accompanying the end of reaction, cool, stirring until it assumes a bright citrine color; dissolve mercury 7 Gm. in nitric acid 10.5 Gm., warming if necessary to prevent crystallizing, and add it to the prepared lard; avoid metallic utensils and containers.

5. *Petroxolinum Hydrargyri. Mercury Petrox. N.F.*—Triturate mercury 30 Gm. with adeps lan. hyd. 13 + acid. oleic. 2, until globules invisible under lens of 10 diameters, then add solid petrox. 55, mix thoroughly.

Unoff. Preps.: Emplastrum Hydrargyri—mercury 30 Gm., oleate of mercury 1, hydrous wool fat 10, melted lead plaster q. s. 100 Gm. *Linimentum Hydrargyri* (Br.)—40 p. c. *Unguentum Hydrargyri Compositum* (Br.)—mercury ointment 40 p. c. (Hg 12 p. c.). *Unguentum Hydrargyri Nitratis* (Br.)—mercury 10 Gm., nitric acid 30 cc., prepared lard 40 Gm., olive oil 70 Gm. *Unguentum Hydrargyri Nitratis Dilutum* (Br.)—mercuric nitrate ointment 20 Gm., soft paraffin, yellow 80 Gm.

Properties and Uses.—Mercury—stimulant, alterative, tonic, antiphlogistic, sorbefacient, not directly a cholagogue, causes salivation; the liver retains it longest. Used in meningitis, bronchitis, pleuritis, pneumonitis, dysentery, rheumatism hydrocephalus, ascites, hydrothorax, dropsy, intestinal obstruction, malarial enlargement of spleen, smallpox. Plaster—applied to syphilitic nodes, glandular engorgements, enlarged spleen, to cover face in smallpox. It not only gives support, but is also a counter-irritant, while the mercury is absorbed and exerts a constitutional effect. Mercury with Chalk—similar to blue mass, only much weaker. Give to children deficient in biliary secretion, indicated by clay-colored stools, bowel complaints, diarrhea, alterative to constitutional syphilis; the chalk is antacid. Blue Mass—sialagogue, alterative, irritant, cathartic; for the first two give gr. 3 (.2 Gm.) nightly or on alternate nights, following in the morning with a laxative; for the last give gr. 5–15 (.3 1 Gm.), at night and follow in the morning with a more active purgative; useful to increase liver and pancreas secretions. Mercurial and Blue Ointments—excellent externally, get resolvent effect by rubbing either upon the swollen or affected parts, and also a constitutional influence. Used in syphilis, when daily inunctions should be made under arms, flanks, thigh, chest, etc., swellings, glandular enlargements, engorged liver, spleen, inflamed joints, orchitis, smallpox eruption, erysipelas, prurigo pudendi, warts, and condylomata. Mercuric Nitrate Ointment—stimulant, alterative, similar to ointments of ammoniated mercury and red mercuric oxide, more stimulating than the former, often occasions salivation; eczema, tinea capitis, impetigo larvalis, psoriasis, pityriasis, psorophthalmia, and inflammation of eye, eyelids, etc.

Hydrargyri Iodidum Flavum. Yellow Mercurous Iodide, HgI, *U.S.P.*—(Syn., Hydrarg. Iod. Flav., Mercurous Iodide, Protoiodide of Mercury, Yellow Iodide of Mercury, Hydrargyri (Proto-ioduretum) Iodidum Viride, Ioduretum Hydrargyrosum; Fr. Proto-iodure de Mercure, Iodure mercureux; Ger. Quecksilberjodid (jodür), Gelbes Jodquecksilber.)

Manufacture: Mix nitric acid and distilled water each 20 cc., cool, pour it upon mercury 50 Gm., after reaction separate, drain, and dry crystals ($HgNO_3 + H_2O$); dissolve 40 Gm. in distilled water 650 cc. + nitric acid 6 cc., to which add slowly, with stirring, potassium iodide 16 Gm. dissolved in distilled water 32 cc., wash well and dry precipitate —$6Hg + 8HNO_3 = 6HgNO_3 + 2NO_3 + 4H_2O$; $2Hg(NO_3) + 2KI = 2HgI + 2KNO_3$. It is a bright yellow, amorphous powder, odorless, tasteless, on exposure to light greenish in proportion as it decomposes into metallic mercury and mercuric iodide; insoluble in alcohol, ether, practically insoluble in water; contains 99 p. c. of pure salt. *Tests:* 1. Slow moderate heat—orange, red, but yellow on cooling; quick strong heat—partially decomposes into mercury and mercuric iodide, finally volatilizes with residue .2 p. c. 2. Heat with dried sodium carbonate (1) in dry glass tube—sublimate of metallic mercury. 3. Heat with sulphuric acid + little manganese dioxide—iodine vapor evolved. *Impurities:* Mercuric iodide, etc. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), ter die, gradually increased until trebled, provided salivation or diarrhea does not occur.

Properties and Uses.—In advanced constitutional syphilis, being by many considered the best salt for this disease.

Hydrargyri Chloridum Corrosivum. Corrosive Mercuric Chloride, $HgCl_2$, *U.S.P.*—(Syn., Hydrarg. Chlor. Corr., Bichloride of Mercury, Corrosive Sublimate, Mercuric Chloride, Perchloride of Mercury, Chloruretum (Chloretum) Hydragyricum; Br. Hydrargyri Perchloridum; Fr. Deutochlorure de Mercure, Chlorure mercurique; Ger. Hydrargyrum bichloratum, Quecksilberchlorid, Sublimat.)

Manufacture: Sublime an intimate mixture of powdered mercuric sulphate and sodium chloride, when the two volatile elements, Hg, Cl, pass over and condense in the cooler as mercuric chloride—$HgSO_4 + 2NaCl = HgCl_2 + Na_2SO_4$; or may add a small portion of manganese dioxide to insure full liberation of chlorine and prevent the formation of mercurous chloride—$HgSO_4 + 2NaCl + MnO_2 = HgCl_2 + Na_2SO_4 + MnO_2$. It is in heavy, colorless, rhombic crystals, crystalline masses, white powder, odorless, characteristic, persistent metallic taste (use great caution in tasting), permanent, soluble in water (13.5), boiling water (2.1), alcohol (3.8), boiling alcohol (1.6), glycerin (12), ether (22), fuses to colorless liquid at 265° C. (509° F.), volatilizes in dense white vapors at 300° C. (572° F.), leaving residue .1 p. c.; aqueous solution (1 in 20) acid, but neutral upon adding sodium chloride; contains 99.5 p. c. of the salt. *Tests:* 1. Aqueous solution with ammonia water

—white precipitate; with excess of hydrogen sulphide—black precipitate; with potassium iodide T. S.—red precipitate, soluble in excess of reagent; with silver nitrate T. S.—white precipitate, insoluble in nitric acid. 2. Dissolve (fine powder) in ether or alcohol—undissolved residue .5 p. c. Should be kept in well-closed containers. Dose, gr. $\frac{1}{50}$–$\frac{1}{8}$ (.0013–.008 Gm.), after meals, in bread pill; as antiseptic dressing the solution (1 in 1000–2000) is valuable.

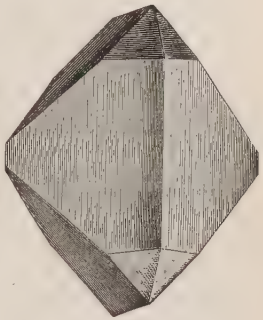


Fig. 467.—Corrosive mercuric chloride crystal.

Incompatibles: Alkalies, their carbonates, potassium iodide, lime water, tartar emetic, lead acetate, silver nitrate, albumin, soap, tannin.

Preparations.—1. *Toxitabellæ Hydrargyri Chloridi Corrosivi.* Poison Tablets of Corrosive Mercuric Chloride. (Syn., Toxitabel. Hydrarg. Chlor. Corr., Corrosive Sublimate Tablets, Bichloride Tablets.)

Manufacture: By compressing equal quantities (7.5 gr. (.5 Gm.)) of corrosive mercuric chloride and sodium chloride, or ammonium chloride, colored blue, preferably with sodium indigotindisulphonate. Tablets must be of angular shape (not discoid), and have stamped distinctly upon each the word "POISON," and the skull-and-cross-bones design; each must weigh gr. 15 (1 Gm.), and contain .45–.55 Gm. of corrosive mercuric chloride and the remainder chiefly sodium chloride, or ammonium chloride; they must be dispensed in securely stoppered glass containers bearing a red label with the word "POISON," and a statement indicating that the tablets contain the required amount of corrosive mercuric chloride.

2. *Elixir Chloridorum. Elixir of Four Chlorides, N.F.,* hydrarg. chlor. corr. .0275 Gm., liq. acid. arsen. 1.65 cc., tr. ferr. chlor. 8.3, acid. hydrochl. dil. 8.3, sp. aurant. co. 1, syrup 25, alcohol 20, aq. dest. q. s. 100 cc. Dose, ʒss–2 (2–8 cc.). 3. *Lotio Flava, Yellow Lotion (Wash), Aqua Phagedænica Flava, N.F.,* $\frac{3}{10}$ p. c., hydrarg. chlor. corr. .3 Gm., boiling water 3.5 cc., liq. calc. hydrox. q. s. 100 cc., externally. 4. *Mulla Hydrargyri Chloridi Corrosivi, N.F.,* hydrarg. chlor. corr. .2 Gm., alcohol 6 cc., sev. benz. 90 Gm., adeps benz. 5.

5. *Hydrargyrum Ammoniatum. Ammoniated Mercury,* $HgNH_2Cl$. (Syn., Hydrarg. Ammon., White Precipitate, Mercurammonium Chloride, Hydrargyrum Ammoniato-muriaticum (Amidato-bichloratum), Hydrargyri Ammonio-chloridum, Mercurius Præcipitatus Albus, Mercur-ammonium Chloride; Fr. Chloramidure de Mercure, Oxychlorure Ammoniacal de Mercure, Lait Mercuriel, Mercure Précipité blanc; Ger. Hydrargyrum præcipitatum album, Weisser Quecksilberpräcipitat, Quecksilber Chloridamid.)

Manufacture: Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 2000 cc., filter, cool, and pour gradually into

ammonia water 150 cc., constantly stirring, wash precipitate with distilled water 400 cc., + ammonia water 20 cc., dry—$HgCl_2 + 2NH_4OH = HgNH_2Cl + NH_3Cl + 2H_2O$. It is in white pulverulent pieces or white, amorphous powder, odorless, earthy, styptic, metallic taste, permanent; soluble in warm hydrochloric, nitric, or acetic acid, cold solution of ammonium carbonate or sodium thiosulphate, with evolution of ammonia which heated—red mercuric sulphide separates; boiled—turns black; insoluble in water, alcohol; by prolonged washing with water gradually decomposes, becoming yellow, basic salt; contains 78–80 p. c. of pure salt. *Tests:* 1. Heat below redness—decomposes without fusion; at red heat—volatilizes with residue .2 p. c. 2. Heat with sodium hydroxide T. S.—turns yellow, evolves ammonia. 3. Dissolve in diluted nitric acid, + potassium iodide T. S.—red precipitate, soluble in excess of reagent; with silver nitrate T. S.—white precipitate. *Impurities:* Mercurous salts, carbonates. Should be kept dark, in well-closed containers.

Prep.: 1. *Unguentum Hydrargyri Ammoniati.* Ointment of Ammoniated Mercury. (Syn., Ung. Hydrarg. Ammon., White Precipitate Ointment, Unguentum Præcipitati Albi; Fr. Pommade de Précipité blanc; Ger. Unguentum Hydrargyri album, Quecksilberpräzipitatsalbe.)

Manufacture: 10 p. c. Triturate ammoniated mercury 10 Gm. with an equal weight of liquid petrolatum, when smooth, add melted white petrolatum 40 Gm., mix thoroughly with hydrous wool fat 40 Gm., stir until congealed.

6. *Hydrargyri Iodidum Rubrum.* Red Mercuric Iodide, HgI_2. (Syn., Hydrarg. Iod. Rub., Mercuric Iodide, Biniodide of Mercury, Red Iodide of Mercury, Deuto-ioduretum (Biniodidum) Hydrargyri, Mercurius Iodatus Ruber, Ioduretum Hydrargyricum; Fr. Deutoiodure (Bi-iodure) de Mercure, Iodure mercurique; Ger. Hydrargyrum bijodatum, Quecksilberjodid, Rotes Jodquecksilber.)

Manufacture: Dissolve corrosive mercuric chloride 40 Gm. and potassium iodide 50 Gm., each, in distilled water 800 cc., filter, pour slowly both simultaneously into water 2000 cc., wash well and dry precipitate—$HgCl_2 + 2KI = HgI_2 + 2KCl$. It is a scarlet-red, amorphous powder, odorless, tasteless, permanent, soluble in alcohol (115), boiling alcohol (20), chloroform (910), ether (120), solutions of soluble iodides, mercuric chloride, sodium thiosulphate, hot solutions of alkali chlorides; practically insoluble in water; contains 99 p. c. of pure salt. *Tests:* 1. Heat to 150° C. (302° F.)—yellow, but red on cooling; at higher temperature, 250° C. (482° F.), fuses to dark yellow liquid, which, on cooling—yellow crystalline mass; at higher heat, 350° C. (662° F.)—volatilizes with residue .2 p. c. 2. Heat with sodium hydroxide T. S., + little lactose—compound reduced, metallic mercury precipitated. 3. Boil .1 Gm. with potassium hydroxide T. S. 2 cc., supersaturate filtrate with nitric acid—yellow liquid from liberation of iodine; blue with starch T. S. *Impurities:* Soluble mercury salts.

Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{50}$–$\frac{1}{8}$ (.0013–.008 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi.* Solution of Arsenous and Mercuric Iodide. (Syn., Liq. Arsen. et Hydrarg. Iod., Donovan's Solution, Solution of Hydriodate of Arsenic and Mercury, Solutio Donovani; Fr. Soluté d'Iodo-arsénite de Mercure Liqueur de Donovan; Ger. Jodquecksilber-Arsenik-lösung, Donovansche Tropfen.)

Manufacture: Rub together in a mortar arsenous iodide and red mercuric iodide, each 1 Gm., add distilled water 15 cc., triturate until dissolved, filter, pass through filter water q. s. 100 cc.; mix thoroughly. It is a clear, colorless, pale yellowish, aqueous liquid, odorless, disagreeable metallic taste; contains .95–1.05 p. c. of each, arsenous iodide, AsI_2, and red mercuric iodide, HgI_2. *Tests:* 1. Mix 1 cc. with distilled water 10 cc., containing a few drops of lead acetate T. S.—bright yellow precipitate. 2. Add a few drops to a mixture (zinc .5 Gm. + diluted hydrochloric acid 5 cc.), cover mouth of test-tube with mercuric bromide test-paper—in 1 minute a yellow stain on inner surface of test paper. Should be kept in well-filled, amber-colored bottles; must not be dispensed if darker than pale yellow. Dose, ♏iij–5 (.2–.3 cc.), ter die, diluted.

Unoff. Prep.: Unguentum Hydrargyri Iodidi Rubri (Br.), 4 p. c.

7. *Hydrargyri Oxidum Flavum.* Yellow Mercuric Oxide, HgO. (Syn., Hydrarg. Oxid. Flav., Hydrargyrum Oxidatum Flavum (Præcipitatum), Precipitated Oxide of Mercury or Mercuric Oxide; Fr. Oxyde mercurique jaune (précipité), Oxyde de Mercure jaune ou précipité, Deutoxide jaune de Mercure; Ger. Hydrargyrum oxydatum via humida paratum, Gelbes (Præcipitirtes) Quecksilberoxyd.)

Manufacture: Dissolve corrosive mercuric chloride 100 Gm. in warm distilled water 1000 cc., filter, also dissolve sodium hydroxide 40 Gm. in cold distilled water 1000 cc. and to this add first solution, constantly stirring, wash well and dry precipitate—$HgCl_2 + 2NaOH = HgO + 2NaCl + H_2O$. It is a light orange-yellow, amorphous, heavy, impalpable powder, odorless, metallic taste, permanent in air, darkens on exposure to light; soluble in diluted hydrochloric or nitric acid (colorless solutions); insoluble in alcohol, practically insoluble in water; moistened with hot distilled water—not alkaline; contains 99.5 p. c. of pure oxide. *Tests:* 1. Heat moderately—red; at red heat, 600° C. (1112° F.)—decomposes completely into oxygen and metallic mercury, finally volatilizes with residue .2 p. c. 2. Dissolve .5 Gm. in 25 cc. of diluted hydrochloric or nitric acid—solution not more than slightly turbid. *Impurities:* Red mercuric oxide, etc. Should be kept dark, in well-closed containers.

Preps.: 1. *Unguentum Hydrargyri Oxidi Flavi.* Ointment of Yellow Mercuric Oxide. (Syn., Ung. Hydrarg. Oxid. Flav.; Fr. Pommade d'Oxyde jaune de Mercure; Ger. Gelbe Quecksilberoxydsalbe.)

Manufacture: 1 p. c. (formerly 10 p. c.). Triturate yellow mercuric oxide 1 Gm. + liquid petrolatum 1, to smooth mixture, add, in divided portions, hydrous wool fat 10, incorporate thoroughly with petrolatum 88 Gm.; avoid iron utensils and containers.

2. *Oleatum Hydrargyri.* Oleate of Mercury. (Syn., Oleat. Hydrarg., Hydrargyrum Oleicum—Oleïnicum—Elaïnicum; Br. Hydrargyrum Oleatum, Oleated Mercury, Mercuric Oleate; Fr. Oléate mercurique (de Mercure); Ger. Oelsaures Quecksilber, Quecksilberoleat, Mercurioleat.)

Manufacture: Mix in a tared dish yellow mercuric oxide 25 Gm. with oleic acid 75 Gm., warm to 50° C. (122° F.), stir constantly for 5 minutes, continue heat, stirring frequently, until yellow mercuric oxide dissolved, add oleic acid q. s. 100 Gm.; avoid contact with metallic utensils. Should be kept dark, in tightly-closed containers, and not dispensed if globules of mercury are visible at the bottom of container. This may well be substituted for mercurial ointment, as it is absorbed more readily; for inflamed joints, indurations following abscesses, sycosis, tinea, psoriasis, eczema, hereditary syphilis.

Prep.: 1. *Unguentum Hydrargyri Fortius,* 2 p. c.

8. *Hydrargyri Salicylas.* Mercuric Salicylate. (Syn., Hydrarg. Salicyl., Mercuric Subsalicylate; Fr. Salicylate mercurique; Ger. Hydrargyrum salicylicum, Mercurisalicylsaure.)

Manufacture: Dissolve corrosive mercuric chloride (27) in water (600), add it to a 4 p. c. sodium hydroxide solution (85) mixed with water (200), wash precipitate (oxide), digest it with water (little) + salicylic acid (15) on water-bath until mixture pure white. It is a white, slightly yellowish or pinkish powder; odorless; tasteless; soluble in solutions of fixed alkalies or their carbonates, warm solutions of alkali halides forming double salts; practically insoluble in water, alcohol; contains 54–59.5 p. c. of mercury. *Tests:* 1. Heat 1 Gm. with hydrochloric acid (10 cc.)—salicylic acid separates on cooling; copper foil added to solution nearly neutralized with ammonia T. S.—becomes coated immediately with metallic mercury; another portion + few drops of ferric chloride T. S.—violet color. 2. Volatilized at 300° C. (572° F.)—residue .2 p. c. *Impurities:* Foreign mercury compounds, free salicylic acid. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), 2–3 times daily; hypodermically with equal quantity of potassium carbonate in distilled water, or intramuscularly, twice a week.

Unoff. Preps.: Liquor Hydrargyri Perchloridi (Br.), .1 p. c., dose, ʒss–1 (2–4 cc.). *Unguentum Hydrargyri Oleati* (Br.), 25 p. c.

Properties and Uses.—Corrosive Sublimate—like many mercury compounds, is tonic, alterative, diuretic, antiseptic, disinfectant, irritant poison; seldom purges, and this can always be prevented by combining it with opium; large doses cause vomiting, griping pain

in bowels, diarrhea, small, irregular pulse; good in advanced syphilis, chronic skin affections and rheumatism, condylomata, engorged glands, diphtheria, pneumonia (injections). Externally—pseudomembranous laryngitis, fetid bronchitis, phthisis, skin diseases (psoriasis, acne, freckles, prurigo pudendi, pityriasis), ophthalmia, granular conjunctivitis, rhus poisoning, malignant pustule, gonorrhea, leucorrhea, dysentery, cholera, hydrocele, wounds, ulcers, arthritis, parasites (pediculi pubis, etc.), vascular tumors. Yellow wash—ill-conditioned sores, ulcers, etc. Ammoniated Mercury—is a less active irritant than some other salts; it is poisonous, and owing to careless manufacture (permitting exposure to light) often contains corrosive mercuric chloride; it is not given internally, and the ointment is of most service in ophthalmia and skin diseases. Red Iodide—is a powerful irritant poison; scrofula, constitutional syphilis, rheumatic pains. Externally—stimulant to indolent syphilitic and scrofulous ulcers, glandular swellings, lupus, goiter, enlarged spleen or liver, granular eyelids, bronchitis, disinfectant; may be applied in solution with potassium iodide (1 in 50), or ointment (1–4 in 20). Donovan's Solution—is given as an alterative in psoriasis, impetigo, porrigo, lepra, pityriasis, lupus, venereal eruptions, chronic rheumatism, night-pains. Yellow Oxide—externally as stimulant escharotic in powder or ointments; chancres, indolent ulcers, corneal ulcers. Salicylate—claimed to be borne best with least influence on alimentary tract, most effective in syphilis, without salivation.

Poisoning: Toxic doses of corrosive sublimate (red iodide, etc.) resemble those of arsenic in effect—have strong metallic taste, frequent bloody evacuations, tenesmus, feeling of constriction in throat, burning in esophagus and stomach, swollen lips and tongue, quick, irregular pulse, cold extremities, intense abdominal pains, vomiting, labored respiration, suppressed urine, syncope, salivation, insensibility convulsions, death. Give egg-white, beaten up with water (1 egg for every 4 grains), follow at once with emetic to remove, hence avoid re-solution of albuminous mercuric compound, demulcents, milk, flour-paste, meat-broth, opiates, potassium iodide, stimulants, heat.

Hydrargyri Chloridum Mite. Mild Mercurous Chloride, HgCl.—(Syn., Hydrarg. Chlor. Mit., Mercurous Chloride, Calomel, Subchloride of Mercury, Protochloride of Mercury, Hydrargyri Chloridum, Hydrargyrum Chloratum (Muriaticum) Dulce, Mercurius Dulcis, Calomelas, Chloruretum (Chloretum) Hydrargyrosum; Br. Hydrargyri Subchloridum; Fr. Protochlorure (Sous-muriate) de Mercure, Mercure doux; Ger. Hydrargyrum chloratum, Quecksilberchlorür, Kalomel.)

Manufacture: Rub mercury (7) with mercuric sulphate (10) to form mercurous sulphate, sublime this with sodium chloride (5), conducting the vapors into a chamber admitting steam simultaneously for dissolving and removing the small amount of mercuric chloride always formed—$Hg + 2H_2SO_4 = HgSO_4 + SO_2 + 2H_2O$; $HgSO_4 +$

Hg = Hg_2SO_4; Hg_2SO_4 + 2NaCl = 2HgCl + Na_2SO_4. It is a heavy, white, impalpable powder, yellowish-white when triturated with strong pressure, showing only small, isolated crystals under magnifying power of 100 diameters; odorless, tasteless, permanent; insoluble in water, alcohol, ether, cold dilute acids; strongly heated, 383° C. (721° F.)—volatilizes without fusion or evolution of brown vapors, leaving residue .1 p. c.; contains 99.6 p. c. of the salt. *Tests:* 1. Contact with calcium hydroxide T. S. solutions of alkali hydroxides, or ammonia water—blackens. 2. Heat with equal weight of dried sodium carbonate in glass tube—sublimate of metallic mercury, which dissolved in nitric acid, + silver nitrate T. S.—white, curdy, precipitate, insoluble in nitric acid. *Impurities:* Mercuric chloride, ammoniated mercury. Should be kept dark, in well-closed containers. Dose, gr. 1–15 (.06–1 Gm.); laxative gr. 2 (.13 Gm.), alterative gr. 1 (.06 Gm.). Children require more in proportion, thus two to three years old give gr. 2–3 (.13–.2 Gm.), and this dose often fails, when it should be followed by castor oil. Better results are obtained by giving small and often-repeated doses, thus gr. $\frac{1}{10}$ (.006 Gm.) hourly in tablet or powder with sugar or sodium bicarbonate (1 in 10) will usually act freely by time the tenth dose is taken.

Preps.: 1. *Pilulæ Hydrargyri Chloridi Mitis Compositæ.* Compound Pills of Mild Mercurous Chloride. (Syn., Pil. Hydrarg. Chlor. Mit. Co., Pilulæ Catharticæ Compositæ, U.S.P. 1910, Antibilious Pills; Fr. Pilules Cathartiques composées; Ger. Abfuhrpillen.)

Manufacture: Mix ext. colocyn. co. 8 Gm., hydrarg. chlor. mit. 6, res. jalap. 2, gamboge 1.5, alcohol dil. q. s. 100 pills. Dose, 1–3 pills. 2. *Lotio Nigra, Black Lotion (Wash), Aqua Phagedænica Nigra, N.F.*, $\frac{875}{10000}$ p. c., hydrarg. chlor. mit. .875 Gm., water 1.5 cc., liq. calc. hydrox. q. s. 100 cc.; shake thoroughly before dispensing and using. 3. *Pulvis Hydrargyri Chloridi Mitis et Jalapæ, N.F.*, hydrarg. chlor. mit. 34 Gm., jalap 66. Dose, 5 15 gr. (.3–1 Gm.). 4. *Tabellæ Hydrargyri Chloridi Mitis, Calomel Tablets, N.F.*, $\frac{1}{10}$ gr. (.0065 Gm.). 5. *Tabellæ Santonini Compositæ, N.F.*, $\frac{1}{2}$ gr. āā—santonin, calomel. 6. *Unguentum Hydrargyri Chloridi Mitis, Calomel Ointment, N.F.*, 30 p. c. + white petrolatum 70.

Properties and Uses.—Purgative, anthelmintic, alterative, cholagogue. Most valuable mercury salt; lessens biliary secretion, causes salivation. Used for syphilis, typhoid, yellow and remittent fevers, inflammatory diseases, pericarditis, endocarditis, pleurisy, pneumonia, meningitis, hepatitis, dropsy, articular rheumatism, dysmenorrhea, iritis, jaundice, pseudomembranous laryngitis, bronchitis, dysentery, cholera, lumbricoid worms. Black Wash—locally to syphilitic ulcers, etc. An ointment (10 p. c.) useful in scaly skin eruptions, condylomata, corneal ulcers, maggots.

Allied Salts:

1. *Hydrargyri Oxidum Rubrum. Red Mercuric Oxide. Red Precipitate, N.F.*—Obtained by dissolving mercury in nitric acid, then either heating alone or triturating this dried mercuric nitrate with mercury and heating—(1) $Hg_3 + 8HNO_3 = 3Hg(NO_3)_2 + 2NO + 4H_2O$. 2. $2Hg(NO_3)_2 + \text{heat} = 2HgO + 4NO_2 + O_2$, or $2Hg(NO_3)_2 + Hg_2 + \text{heat} = 4HgO + 2N_2O_4$. It is in heavy orange-red crystalline scales or powder, acquiring yellow color when finely divided; odorless; metallic taste; permanent; soluble in diluted nitric acid (clear solution), hydrochloric acid, 1 in 10 (faint opalescence); insoluble in alcohol, almost insoluble in water. Heated to 400° C. (752° F.)—dark violet, black assuming original color on cooling; .5 Gm. dissolved in 25 cc. hydrochloric or nitric acid—slight turbidity; contains 99.5 p. c. of pure oxide. *Impurities:* Yellow mercuric oxide, nitrate. Not used much internally, but mostly externally as stimulant, escharotic; ulcers, wounds, indolent syphilitic sores, condylomata, corneal opacity, granular eyelids, pannus, ozena, in powder or ointment. The yellow oxide (chemically identical) has nearly replaced it. Should be kept dark, in well-closed containers. Dose, gr. $\frac{1}{10}$ (.006 Gm.), in syphilis; 1. *Unguentum Hydrargyri Oxidi Rubri,* 10 p. c.; avoid metallic utensils. *Liquor Hydrargyri Nitratis,* hydrarg. oxid. rub. 40 Gm., acid. nitric. 45 Gm., aq. dest. 15 Gm.; caustic for cancers, lupus, chancres, acne, sores, boils—very poisonous.

2. *Hydrargyri Subsulphas Flavus. Yellow Mercuric Subsulphate* (Turpeth Mineral), $Hg(HgO)_2SO_4$, U.S.P. 1820–1890.—Obtained by dissolving mercury 100 Gm. in sulphuric acid 30 cc. + distilled water 15 cc., adding gradually nitric acid 25 cc. + distilled water 25 cc., evaporating to dryness, powdering, and adding it gradually to boiling distilled water 2000 cc., boiling 10 minutes (to convert normal into basic sulphate, the acid sulphate remaining in solution), washing and drying precipitate—$Hg_3 + 3H_2SO_4 + 2HNO_3 = 3HgSO_4 + 2NO + 4H_2O$. It is a heavy lemon-yellow powder, odorless, tasteless, permanent, soluble in HNO_3, HCl, water (2000), boiling water (600), insoluble in alcohol. *Impurities:* Mercurous salt, lead; should be kept in the dark, in well-stoppered bottles. Alterative, emetic, errhine, irritant poison, salivates; croup, spasmodic laryngitis. Dose, gr. 2–3 (.13 .2 Gm.), for child 2 years old, repeated in 15 minutes; as alterative for adult, gr. $\frac{1}{4}$–$\frac{1}{2}$ (.016–.03 Gm.); emetic, gr. 2–5 (.13–.3 Gm.); errhine, gr. 1 (.06 Gm.) + starch q. s.; gr. 60 (4 Gm.) have killed.

3. *Hydrargyri Sulphidum Rubrum. Red Sulphide of Mercury. Cinnabar,* HgS, U.S.P. 1820 1880.—Obtained by gradually adding mercury (40) to melted sublimed sulphur (8), constantly stirring; the mass is heated until it begins swelling, then cooled under close cover, rubbed into powder, and sublimed. It is a mercuric salt, and occurs in brilliant dark red crystalline masses or bright scarlet powder, odorless, tasteless, permanent, insoluble in water, alcohol, nitric or hydrochloric acid, soluble in nitromuriatic acid, sp. gr. 8.12. *Impurities:* Arsenic,

antimony, chromates, iodides, sulphides, red oxide of mercury, red oxide of lead. By fumigation as a sialagogue in syphilitic affections.

4. *Hydrargyri Cyanidum. Mercuric Cyanide,* $Hg(CN)_2$, U.S.P. 1830–1890.—Obtained by dissolving mercuric oxide in hydrocyanic acid, the latter being prepared from potassium ferrocyanide and sulphuric acid—$HgO + 2HCN = Hg(CN)_2 + H_2O$; usually by passing HCN gas into mercuric oxide in water, when soluble $Hg(CN)_2$ is formed, evaporating to crystallize. It is in white prismatic crystals, odorless, bitter, metallic taste, darkens by light, exceedingly poisonous, soluble in water (12.8), alcohol (12). *Impurities:* Mercuric chloride, etc.; should be kept in well-stoppered bottles. Used instead of corrosive sublimate for constitutional syphilis, diphtheria (gargle 1 in 10,000). Dose, gr. $\frac{1}{16}$–$\frac{1}{8}$ (.004–.008 Gm.).

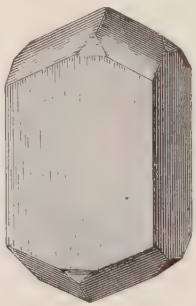


Fig. 468.—Mercuric cyanide crystal.

5. *Mercuric Sulphate-Ethylenediamine. Sublamine,* $HgSO_4 2C_2H_4(NH_2)_2 + 2H_2O$.

Manufacture: By combining one molecule of mercuric sulphate and two molecules of ethylenediamine. Occurs in white alkaline needles, soluble in water, glycerin (10), sparingly in alcohol; contains 44 p. c. of mercury; does not precipitate albumin, is incompatible with sodium chloride, and should not be exposed to the air.

Properties and Uses.—Disinfectant, similar to mercuric chloride, but is more soluble and penetrating, and less irritating; dermatology, gynecology, ophthalmology, otology, in solutions—1:1000, 3000, 5000, the weaker for skin disinfection, the stronger for irrigations of the bladder, etc.; 3–4 p. c. solution may be injected into gluteal muscles for syphilis.

6. *Mercurochrome. Soluble Mercuramine. Disodium Salt of Hydroxymercuri-dibromfluorescein,* $C_{20}H_7Br_2(HgOH)O_5Na_2$.—An organic mercury derivative having mercury bound to the dye molecule without yielding mercury ions. It is in dark green iridescent scales, granules, slightly hygroscopic, soluble in water (bright red solutions), 1.5 p. c. soluble in 95 p. c. alcohol, 4 p. c. in 75 p. c. alcohol, 27.5 p. c. in 50 p. c. alcohol, precipitated by acids but not by proteins or normal acid urine,

hence a non-irritant to tissues; contains 23–24 p. c. of mercury. Powerful germicide, urinary antiseptic, disinfectant, alterative—a stain bearing a potent germicide that penetrates deep tissues and mucous membranes where bacteria may have reached; bladder, eye, fauces, kidney, nose, etc.; urethritis, cystitis (1 p. c. solution), ophthalmia neonatorum (2 p. c.), diphtheria, pyorrhea (mouth wash), septicemia, pyelitis, abscesses (1 p. c. solution—intravenous injection). Objectionable owing to staining fabrics and skin—removed by hypochlorite solutions, or 2 p. c. potassium permanganate solution followed by 5 p. c. oxalic acid solution; substitute for tincture of iodine.

ARSENUM (ARSENICUM). ARSENIC.

$As^{iii-v} = 74.96$.

The element arsenic (L. *arsenicum*, fr. Gr. *αρσενικόν*, orpiment; lit. masculine, strong—*i. e.*, powerful poison), U.S.P. 1850–1870, is distributed widely, but generally in small quantities; occurs as native arsenic (cobaltum or fly-stone), as two sulphides (red orpiment or realgar, As_2S_2, and yellow orpiment, As_2S_3), and as arsenides of various metals (arsenical pyrites or mispickel, FeAsS, cobalt glance, CoS_2,-$CoAs_2$, and tin-white cobalt, $CoAs_2$). The metal may be obtained by heating arsenical pyrites—FeS_2,$FeAs_2$ + heat = 2As + 2FeS. Arsenic being volatile, passes over, condenses, and should be purified by heating with charcoal, as it may contain As_2O_3; thus, $As_2O_3 + 3C = 3CO + 2As$. Metal is a steel-gray, metallic mass, losing luster by forming a film of oxide, brittle, volatile, sp. gr. 5.73–5.88; used as a fly-poison and in shot (alloy of lead and arsenic); forms two kinds of salts—*arsenous* (lower) and *arsenic* (higher).

Tests for Arsenic Salts: 1. H_2S in acid solution precipitates bright yellow arsenous sulphide, As_2S_3, from arsenous compounds, soluble in ammonia water; orange-yellow arsenic sulphide, As_2S_5, from arsenic compounds. 2. $AgNO_3$ with ammonia water precipitates in neutral solutions of arsenous acid yellow silver arsenite, Ag_3AsO_3, in neutral arsenic acid solution get reddish-brown precipitate of silver arsenate, Ag_3AsO_4. 3. Cupric sulphate + arsenous acid + ammonia water precipitates Scheele's green—cupric arsenite, $CuHAsO_3$. 4. Marsh's test: Add to arsenic solution Zn + H_2SO_4, the escaping hydrogen gas from arsene, AsH_3, and when ignited deposits brown metallic ring upon cold porcelain, soluble in solution of chlorinated lime (bleaching-powder). 5. Reinsch's test: Add bright copper plate to acid arsenical solution, heat, when it becomes coated with film of metallic arsenic.

Arseni Trioxidum. Arsenic Trioxide, As_2O_3, *U.S.P.*—(Syn., Arsen. Triox., Arsenous Acid, White Arsenic, Arsenous Oxide, Arsenic, Flowers of Arsenic, Arsenicum Album; Br. Acidum Arseniosum, Arsenious Anhydride; Fr. Acide arsénieux, Arsenic blanc, Fleurs, d'Arsenic; Ger. Acidum arsenicosum, Arsenige Säure, Weisser Arsenik.)

Manufacture: This is often a by-product in separating metal from the ores (cobalt, nickel, tin, silver, arsenical iron pyrites) metallurgically, when by roasting it sublimes; it becomes acid only in the presence of water—$2As_2O_3 + 6H_2O = 4H_3AsO_3$. It is a heavy solid—either an opaque, white powder, or irregular masses of two varieties; one amorphous, transparent, colorless like glass; the other crystalline, opaque, white, resembling porcelain; often same piece has opaque, white outer crust enclosing the glassy variety, the latter being converted into the former when exposed to moist air; both odorless, tasteless, slowly soluble in water, the glassy (30) more so than the crystalline (100), slightly soluble in alcohol, ether, freely in glycerin, hydrochloric acid, solutions of alkali hydroxides and carbonates heated slowly—sublimate of minute crystals, heated rapidly to 200° C. (392° F.)—glassy—fuses, sublimes; crystalline—sublimes without fusing—residue .1 p. c.; contains 99.8 p. c. of pure tri-oxide. *Tests:* 1. Heat slowly in dry test-tube—sublimate of octahedral crystals, not yellow (abs. of arsenous sulphide). 2. Heat strongly with charcoal—reduced metallic arsenic deposits on cooler portion of tube as a mirror, having a metallic luster soluble in chlorinated lime or soda solutions. 3. Aqueous solution faintly acid; solution in ammonia T. S., 1 in 10 (gentle heat)—colorless solution. *Impurities:* Antimony, tin, cadmium, arsenous sulphide. Dose, gr. $\frac{1}{30}$–$\frac{1}{15}$ (.002–.004 Gm.), on full stomach, until puffiness of eyelids or curative effect produced. Powdered arsenic

Fig. 469.—Sublimate arsenic trioxide, magnified.

trioxide when administered in solid form—powders, pills, or tablets, must consist of particles no greater than .0125 Mm. ($\frac{1}{2000}'$) broad.

Preparations.—1. *Liquor Acidi Arsenosi.* Solution of Arsenous Acid. (Syn., Liq. Acid. Arsen., Solution of Arsenic Chloride; Br. Liquor Arsenici Hydrochlorici; Hydrochloric Solution of Arsenic; Fr. Liqueur arsénicale hydrochlorique; Ger. Chlorarseniklösung.)

Manufacture: 1 p. c. Mix in a tared flask diluted hydrochloric acid 5 Gm. with distilled water 25 cc., add arsenic trioxide 1 Gm., boil until dissolved, cool, transfer to 100 cc. graduated flask, rinsing first vessel with several portions of distilled water, add rinsings and distilled water q. s. 100 cc., filter. It is a clear, colorless aqueous liquid, odor-

less, acidulous taste, acid reaction; contains in each 100 cc., arsenous acid equivalent to .975–1.025 p. c. of arsenic trioxide. *Tests:* 1. With hydrogen sulphide T. S.—lemon-yellow precipitate (arsenic trisulphide), soluble in ammonium carbonate T. S. Dose, ♏iij–5 (.2–.3 cc.), ter die, diluted.

Prep.: 1. *Elixir Chloridorum, N.F.*, 1.65 p. c.

2. *Liquor Potassii Arsenitis.* Solution of Potassium Arsenite. (Syn., Liq. Pot. Arsen., Fowler's Solution, Liquor arsenicalis Fowleri (P.I.), Arsenical Solution, Kali Arsenicosum Solutum; Fr. Liqueur (Solution) arsenicale de Fowler; Ger. Liquor Kalii arsenicosi, Fowlersche Lösung (Tropfen).)

Manufacture: 1 p. c. Boil arsenic trioxide 1 Gm., potassium bicarbonate 2 Gm., with distilled water 10 cc. until dissolved, cool, add distilled water q. s. 97 cc., add compound tincture of lavender 3 cc., mix thoroughly, filter. It is a clear, faintly opalescent aqueous liquid (solution), pinkish, slight odor of lavender, alkaline; contains potassium arsenite, equivalent to .975–1.025 p. c. of arsenic trioxide. *Test*: 1. Acidulate strongly 10 cc. with hydrochloric acid, add equal volume of hydrogen sulphide T. S.—yellow precipitate, soluble in ammonium carbonate T. S. *Impurities:* Arsenate, etc. Dose, ♏iij–5 (.2–.3 cc.), ter die, diluted.

3. *Arseni Iodidum.* Arsenous Iodide, AsI_3. (Syn., Arsen. Iod., Arsenic Tri-iodide, Arsenici Iodidum, Ioduretum Arseniosum; Fr. Iodure d'Arsenic; Ger. Arsenicum (Arsenum) jodatum, Arsenik Jodur, Arsentrijodid.)

Manufacture: 1, $As_2O_3 + 6HCl$ (hot) $= 2AsCl_3 + 3H_2O$, which by double decomposition with KI gives AsI_3: $2AsCl_3 + 6KI = 2AsI_3 + 6KCl$; 2, $As_2O_3 + 6HI = 2AsI_3 + 3H_2O$; 3, triturate and heat together metallic arsenic 75 parts and iodine 380. It is an orange-red, inodorous, crystalline powder, stable when kept cool and dark, soluble with partial decomposition in water (12), alcohol, chloroform, ether, carbon disulphide; heated on water-bath—loses no iodine, beyond that volatilizes—residue .5 p. c.; contains 99 p. c. of pure salt. *Tests:* 1. Aqueous solution (colorless, upon standing yellow (due to liberation of iodine)—decomposing into arsenous, hydriodic acids) + hydrochloric acid + hydrogen sulphide T. S.—lemon-yellow precipitate (arsenous sulphide). 2. Aqueous solution (1 in 20) 5 cc. + chlorine water 1 cc.—liberates iodine, solution light reddish-brown; agitate mixture with little chloroform—latter violet. Should be kept cool, dark, in amber-colored, glass-stoppered vials. Dose, gr. $\frac{1}{20}$–$\frac{1}{10}$ (.003–.006 Gm.).

Prep.: 1. *Liquor Arseni et Hydrargyri Iodidi*, 1 p. c.

4. *Liquor Auri Bromidi et Arseni, N.F.*, $\frac{1}{4}$ p. c. 5. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N.F.*, $\frac{1}{20}$ gr. 6. *Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, N.F.*, $\frac{1}{50}$ gr.

Unoff. Prep.: Liquor Arsenicalis, Clemens—arsenic trioxide 1, potassium bicarbonate 4, bromine .5, water q. s. 100, dose, ♏iij–5 (.2–.3 Gm.).

Properties and Uses.—Arsenic Trioxide—alterative, anaphrodisiac, irritant poison, nervine, tonic; chronic malaria, intermittents, skin diseases (eczema, psoriasis, lepra, prurigo), nervous debility, chorea (best remedy—almost a specific), chronic rheumatism, gout, constitutional syphilis, frontal neuralgia, hemicrania, obesity, gastralgia, anemia, spasmodic asthma, amenorrhea, dysmenorrhea, menorrhagia, leucorrhea, diabetes, albuminuria, chronic diarrhea. Externally—cancers, lupus, epithelial tumors, sarcoma, warts, malignant ulcers, carious teeth. The two liquors are good forms for administration, but it may also be given in tablet, pill, etc. Arsenic Iodide—alterative, irritant poison, used like the acid, but mostly in pill form, and never should be applied on abraded surfaces; Donovan's solution and the ointment ($\frac{1}{2}$–1 p. c.) have merited popularity.

Poisoning: All arsenic compounds produce symptoms resembling those of cholera: constriction and heat of fauces, faintness, nausea, burning abdominal pain and tenderness, thirst, violent retching, vomiting (brown often streaked with blood), bloody stools, tenesmus, strangury, cold skin, small and feeble pulse, spasms, dyspnea, death in collapse. Wash out stomach, give emetics, follow with recently prepared ferric hydroxide or ferric hydroxide with magnesium oxide, dialyzed iron, to envelop, as well as to form insoluble ferric arsenite, or arsenate, chalk, lime water, demulcents, opiates, stimulants, heat, spirit of ethyl nitrite, remove iron compound with zinc sulphate.

Incompatibles: Salts of iron, silver, copper, ammonium, calcium, magnesium oxide, vegetable astringents.

Synergists: Restoratives, nux vomica, etc.

Arsphenamina. Arsphenamine. $HCl.NH_2.OH.C_6H_3A_5{:}AsC_6H_3.OH.$-, $NH_2HCl.2H_2O$, *U.S.P.*—(Syn., Arsphen., Diaminodihydroxyarsenobenzene Hydrochloride, Salvarsan, 606, Arsaminol, Arsenobenzol, Arsen-phenolamine Hydrochloride, Kharsivan; Ger. Salvarsan.)

Manufacture: By the nitration of paroxy-phenyl-arsenic acid and subsequent reduction and condensation of the resulting nitrophenyl-arsenic acid, which base is then converted into dihydrochloride. It is a light yellow powder, odorless, slight odor, hygroscopic, oxidized by exposure, dry or in solution, becoming darker and more toxic, soluble in water, alcohol, glycerin, slightly in chloroform, ether; contains not less than 30 p. c. of arsenic (As). *Tests:* 1. Aqueous solution (1 in 100) acid to litmus (dif. from neoarsphenamine). 2. Add sodium hydroxide T. S. drop by drop—precipitate, soluble in excess of reagent (dif. from neoarsphenamine). 3. Add to aqueous solution (1 in 100) sodium carbonate T. S., or solution of sodium bicarbonate—precipitate, insoluble in excess; or add mercuric potassium iodide T. S.—precipitate (dif. from neoarsphenamine). *Impurities:* Neoarsphenamine, etc. Should be kept in sealed containers of colorless glass from which air has been excluded by vacuum or by displacement with a non-oxidizing gas. Dose, gr. 5–9 (.3–.6 Gm.); children gr. 3–5 (.2–.3 Gm.)—intra-

venous, intramuscular, intrarectal injection, the first preferable, ½ p. c. solution, at body temperature, injected very slowly at weekly intervals. Full doses best and the earlier the treatment the better, becoming practically a specific for syphilis if administered in the first stage; less satisfactory later.

Preparation.—1. *Neoarsphenamina.* Neoarsphenamine, [$NH_2.OH.C_6H_3As:AsC_6H_3.OH.NH(CH_2O)OSNa$], *U.S.P.* (Syn., Neoarsphen., Neosalvarsan, Novarsenobenzol, Neokharsivan.)

Manufacture: By the action of sodium menthanol sulphoxylate on arsphenamine, and consists partially of sodium 3-diamino 4-dihydroxyarsenobenzene methanol sulphoxylate. It is a yellow powder, odorless, slight odor, dry or in solution readily oxidized by exposure, accelerated by heat, becoming darker, more toxic, very soluble in water, glycerin, slightly in alcohol, almost insoluble in acetone, chloroform, ether; contains 19 p. c. of As. *Tests:* 1. Aqueous solution (1 in 100) neutral, slightly alkaline, (*a*) + diluted mineral acids—precipitate; (*b*) + solutions of alkali hydroxides or carbonates—no precipitate, (*c*) + mercuric potassium iodide T. S.—no precipitate (dif. from arsphenamine). 2. Aqueous solution (1 in 1000) 5 cc., + 2 drops fresh ferric chloride T. S. —purple, purplish-red, dark red. *Impurities:* Arsphenamine. Should be kept cool, not above 10° C. (50° F.), in original sealed tubes of colorless glass, from which air has been excluded by vacuum or by displacement with a non-oxidizing gas, and solutions must be freshly prepared for use. Dose, gr. 9–14 (.6–.9 Gm.).—Inject each 2.5 gr. (.16 Gm.) in ℿxlv (3 cc.) distilled water—isotonic solution.

Properties and Uses.—Germicide, especially deadly to germs of the *Spirochæta* genus—those inducing syphilis, relapsing, rat-bite and yellow fever, etc., the first being the most important; sleeping sickness, frambesia, malaria, dysentery, trench diarrhea, septicemia (streptococci). May produce alarming symptoms and death (1 in 18,000 injections).—either chill, fever, nausea, vomiting, lasting several hours, followed by herpetic eruptions, or choking, flushed face, difficult heart and respiratory action (''nitritoid crisis''), for which epinephrine has been found a most valuable preventive as well as cure; substitute for arsenic in diseases of skin, nerves, blood; should not be employed in presence of eye troubles. Neoarsphenamine is more soluble, safer, but less efficient and larger dosage than arsphenamine.

ANTIMONIUM. ANTIMONY (Stibium).

$Sb^{iii-v} = 120.2.$

The element antimony (Gr. *ἀντί*, against, + *moine*, monk—monk's-bane, poisons monks; or Gr. *ἀντί*, against, + *μόνος*, alone—never found alone; or Gr. *ἀντί*, instead of, + L. *minium*, red lead—women once used it instead of red lead for painting around the eyes; L. *stibium*, *στίβι*, name of sulphide of antimony), U.S.P. 1820–1830, has several official compounds, and occurs natively uncombined, also as oxide,

oxysulphide, and mostly as sulphide. From this latter the metal is obtained by roasting it into an oxide, then reducing that with charcoal. It is brittle, bluish-white like silver, crystalline structure, sp. gr. 6.7; forms *antimonous* and *antimonic* compounds.

Tests for Antimony Salts: 1. H_2S in acid solution precipitates orange-red antimonous or antimonic sulphide, Sb_2S_3 or Sb_2S_5, soluble in ammonia water. 2. The sulphide dissolved in HCl and thrown into water precipitates white oxychloride. 3. Zinc and iron precipitate antimony as black powder from its solutions, while copper precipitates it as a black metallic film upon itself, which when heated volatilizes the antimony, depositing it as antimonous oxide. 4. Marsh's test; here brown rings are produced on porcelain, as in arsenic, which are insoluble in solution of chlorinated lime (bleaching-powder).

Antimonii et Potassii Tartras. Antimony and Potassium Tartrate, $K(SbO)C_4H_4O_6.\frac{1}{2}H_2O$, *U.S.P.*—(Syn., Antim. et Pot. Tart., Antimonyl Potassium Tartrate, Tartrated Antimony, Tartar Emetic; Antimonium Tartarisatum, Tartarus Emeticus, Stibio-kali Tartaricum; Br. Antimonium Tartaratum, Tartarated Antimony; Fr. Tartrate d'Antimoine et de Potasse, Emetique, Tartre stibié; Ger. Tartarus stibiatus, Brechweinstein.)

Manufacture: Antimony oxide 150 Gm. + potassium bitartrate 180 Gm. + water 1000 cc., boil 1 hour, crystallize—$Sb_2O_3 + 2KHC_4H_4O_6 = 2K(SbO)C_4H_4O_6,H_2O$. It is in colorless, transparent, rhombic crystals (effloresceing upon exposure), white granular powder, odorless, sweet disagreeable metallic taste; soluble in water (12), boiling water (3), glycerin (15), insoluble in alcohol; aqueous solution slightly acid; contains 98.5 p. c. of pure salt. *Tests:* 1. Heated to redness—chars, odor of burning sugar, blackened alkaline residue imparting violet flame. 2. Aqueous solution (1 in 20) + few drops of hydrochloric acid + hydrogen sulphide T. S.—orange-red precipitate, soluble in ammonium sulphide T. S. or potassium hydroxide T. S. *Impurities:* Iron, arsenic. Should be kept in well-closed containers. Dose, alterative, gr. $\frac{1}{32}$–$\frac{1}{16}$ (.002–.004 Gm.); diaphoretic, expectorant, gr. $\frac{1}{12}$–$\frac{1}{6}$ (.005–.01 Gm.); nauseating sudorific, gr. $\frac{1}{6}$–$\frac{1}{4}$ (.01–.016 Gm.), every few hours; emetic, gr. $\frac{1}{2}$ (.03 Gm.), repeated every 20 minutes with warm water or chamomile tea until vomiting occurs.

Preparations.—1. *Mistura Glycyrrhizæ Composita*, $\frac{1}{42}$ p. c. 2. *Syrupus Scillæ Compositus*, $\frac{1}{5}$ p. c. 3. *Tinctura Antimonii, N.F.*, $\frac{2}{5}$ p. c., antim. et pot. tart., $\frac{2}{5}$ Gm., aq. dest. (boiling) 2.5 cc., æth. acet., caramel, āā $\frac{1}{5}$, alcohol 20, aq. dest. q. s. 100 cc. Dose, ♏v–15 (.3–1 cc.); used instead of the wine.

Unoff. Preps.: Vinum Antimonii: antimony and potassium tartrate .4 Gm., boiling distilled water 2.5 cc., sherry wine q. s. 100 cc. Dose, ♏x–30 (.6–2 cc.), repeated as desired; as emetic for children, ʒss–1 (2–4 cc.), repeated every 15 minutes until vomiting occurs.

Properties and Uses.—Sedative, diaphoretic, expectorant, antiphlogistic, emetic, febrile complaints, first stage of bronchitis, pneumonia, pleurisy, acute rheumatism, tonsillitis, mammary abscess, hernia humoralis, ophthalmia, mumps, skin affections (eczema, urticaria, psoriasis), dropsy, salivation, meningitis, epilepsy, chorea, mania, convulsions, mania-à-potu, rigid os uteri, strangulated hernia, dislocations, nevi, varicose veins. Externally—applied in strong solution or ointment causes pustular eruptions like those of smallpox, producing scabs and indelible scars. Tincture (antimony wine)—a good form for diaphoresis in fever crisis, febrifuge, expectorant.

Poisoning: Symptoms similar to arsenic, but less marked; have metallic taste, abdominal pain, incessant, retching, precordial cramps, burning heat, distended epigastrium, colic, frequent watery stools, dry throat, salivation, difficult deglutition, skin cool, clammy, muscles relaxed, pulse feeble, thready, respiration slow, scanty bloody urine, death may be preceded by stupor, mild delirium, or convulsions. Place in horizontal position, lower head, wash out stomach with solution of tannic acid, green tea, or galls, then demulcent drinks, egg-white, milk, warmth, friction, electricity, opium, stimulants; tartar emetic gr. 2–5 (.13–.3 Gm.) have killed.

Incompatibles: Opium, alcohol, cardiac stimulants, antispasmodics, tannin, gallic acid, lead salts.

Synergists: Emetics, cathartics, cardiac depressants.

Allied Salts:

1. *Antimonii Oxidum. Antimony Oxide*, Sb_2O_3, *N.F.*—Obtained by pouring a solution of antimony chloride into water, thus precipitating the oxychloride, which is to be decomposed by sodium carbonate. It is a white, grayish-white powder, odorless, tasteless, permanent, insoluble in water, alcohol, ether, nitric acid, soluble in hydrochloric acid without effervescence, warm aqueous solutions of tartaric acid or boiling solution of potassium bitartrate, when heated—turns yellow, but again white on cooling; dull red heat—fuses to yellowish liquid, higher—volatilizes. Dissolve in hydrochloric acid, then largely diluted—white precipitate, changed by hydrogen sulphide to orange; contains 97 p. c. of pure oxide. *Impurities:* Copper, lead, chloride, sulphate. Seldom used in medicine, although possessing antimonial properties; owing to limited solubility only nauseates and vomits slightly. Dose, gr. 2–4 (.13–.26 Gm.); 1. *Pulvis Antimonialis. James' Powder*, 33 p. c., antim. oxid. 33 Gm., calc. carb. præc. 67. Dose, gr. 3–5 (.2–.3 Gm.). *Impurities:* Iron, copper, lead, arsenic, chloride, sulphate. Seldom used in medicine, although possessing antimonial properties; owing to its limited solubility does not nauseate or vomit very much.

2. *Antimonii Sulphidum. Antimony Sulphide*, Sb_2S_3, U.S.P. 1820–1890.—This is native antimony sulphide purified by fusion and as free from arsenic as possible; the grayish-black ore, stibnite (Europe, United States), containing galena, iron pyrites, quartz, and heavy spar, is heated in pots, whereby fusible antimony sulphide runs off into

earthen vessels to cool. It is in steel-gray masses, metallic luster, striated, crystalline fracture, forming grayish-black lusterless powder, odorless, tasteless, permanent, soluble in HCl, insoluble in water, alcohol. Dose, freely in veterinary practice.

3. *Antimonii Sulphidum Purificatum. Purified Antimony Sulphide,* Sb_2S_3, U.S.P. 1880–1890.—Obtained by taking finely powdered antimony sulphide 100 Gm., removing coarser particles by elutriation, and macerating for 5 days the fine subsiding sulphide in ammonia water 50 cc., agitating frequently to remove any arsenic present, then washing with water and drying. It is a heavy, blackish, lusterless powder, odorless, tasteless, permanent, insoluble in water, alcohol, soluble in HCl with evolution of hydrogen sulphide. *Impurities:* Arsenic, etc. Used only for pharmaceutical purposes, not prescribed internally to any extent. Dose, gr. 10–30 (.6–2 Gm.), in powder or bolus.

4. *Antimonium Sulphuratum. Sulphurated Antimony. Kermes Mineral,* chiefly Sb_2S_3, U.S.P. 1860–1890.—Obtained by boiling 2 hours purified antimony sulphide 100 Gm., solution sodium hydroxide 1200 cc., distilled water 3000 cc., stirring frequently, and adding water to preserve volume; strain, drop into it, while hot, diluted sulphuric acid q. s. to precipitate completely, wash precipitate with hot distilled water, dry, pulverize. It is an amorphous, reddish-brown powder, odorless, tasteless, losing color on exposure, insoluble in water, alcohol. *Impurities:* Calcium, chloride, sulphate. Alterative, diaphoretic, emetic, but an uncertain medicine. Dose, alterative, gr. 1–2 (.06–.13 Gm.), twice daily, in pill; emetic, gr. 5–20 (.3–1.3 Gm.). Plummer's Pills (*Pilulæ Antimonii Compositæ*, U.S.P. 1890), $\frac{3}{5}$ gr. (.036 Gm.), + mild mercurous chloride $\frac{3}{5}$, guaiac $1\frac{1}{5}$, castor oil q. s.; used in secondary syphilis, skin eruptions, and while taking should avoid acids. Dose, 1–3 pills.

Allied Metals:

1. *Stannum, Tin,* $Sn^{ii-iv} = 118.7$. The element tin (AS, *tin, stean, stan,* a stone; L. *stannum,* found as oxide, tin-stone), U.S.P. 1820–1850, occurs chiefly as native stannic oxide (tin-stone), SnO_2. The metal is obtained by heating this oxide with carbon—$SnO_2 + 2C = Sn + 2CO$. It is a nearly silver-white metal, very malleable, fusing at 228° C. (440° F.); forms two series of compounds, *stannous* and *stannic;* used in alloys, with mercury to silver mirrors, and to coat sheet iron to yield tin plate; stannous chloride, $SnCl_2$, is a strong deoxidizing agent used to precipitate the metals mercury and gold, and as a mordant in calico-printing. *Tests for Tin Salts:* 1. With H_2S in stannous solution get brown stannous sulphide. 2. With H_2S in stannic solution get yellow stannic sulphide, both precipitates being soluble in ammonium sulphide.

2. *Aurum. Gold,* $Au^{i-iii} = 197.2$. The element gold (AS. *geolu, giolo,* yellow; Gr. χλωρός; L. *aurum,* yellowish—*i. e.*, color of the metal), U.S.P. 1820–1830, usually occurs in the metallic state with other metals, but sometimes as sulphide. It is separated from adhering rock,

sand, etc., by washing, its greater specific gravity (19.3) causing it to subside. When pure it is quite soft, so that for general use it is alloyed with harder metals. Jewelers recognize the pure metal as 24 carat (seldom employed), and when mixed with 25 p. c. of copper or silver as 18 carat. It is affected by none of the pure acids, being dissolved only by nitrohydrochloric acid, free chlorine or bromine, and mercury, forming with this latter an amalgam. *Tests for Gold Salts:* 1. H_2S precipitates brown auric sulphide, Au_2S_3, soluble in ammonium sulphide. 2. $FeSO_4$ added and set aside soon precipitates metallic gold in dark powder, which by fusion is converted into a metallic button. 3. Stannous chloride precipitates purple, of Cassius.

1. *Auri et Sodii Chloridum. Gold and Sodium Chloride,* U.S.P. 1820–1830, 1880–1910.—Obtained by dissolving gold (13) in a mixture of nitric acid (16) and hydrochloric acid (48), adding water (40), + pure dry sodium chloride (20), evaporating to dryness with constant stirring —(1) $Au_2 + 2HNO_3 + 8HCl = 2HAuCl_4$, or $2(AuCl_3 + HCl) + 2NO + 4H_2O$. (2) $HAuCl_4 + NaCl = NaAuCl_4$ or $(AuCl_3 + NaCl) + HCl$. It is a mixture of equal parts of anhydrous gold chloride, $AuCl_3$, and anhydrous sodium chloride, NaCl, representing, when dried, at least 30 p. c. of metallic gold; it is an orange-yellow powder, odorless, saline metallic taste, deliquescent in damp air, soluble in water; alcohol or ether dissolves the gold chloride leaving the sodium chloride. Action similar to that of mercury, used for syphilis, scrofula, sclerosis of the spine, liver, and kidneys, hypochondriasis, asthma, dysmenorrhea, migraine, epilepsy, chorea, hysteria, consumption, habitual inebriety. Externally—caustic, like $AgNO_3$, for lupoid, cancerous, and other ulcers. Should be kept in well-stoppered, amber-colored vials. Dose, gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.016 Gm.); supposed to be an important agent in the "Keeley cure," associated with hypodermics of atropine, strychnine, etc. In addition to the double chloride, the bromide, iodide, and oxide also are used in doses of gr. $\frac{1}{20}$–$\frac{1}{4}$ (.003–.016 Gm.), after meals; also the powdered metal may be given in doses gr. $\frac{1}{6}$–1 (.01–.06 Gm.).

2. *Acidum Bromauricum. Bromauric Acid,* $HAuBr_4.5H_2O$, *N.F.*—Obtained by the action of bromine on metallic gold, and dissolving this auric bromide in hydrobromic acid—$AuBr_3 + HBr. + 5H_2O = HAuBr_4.5H_2O$. It is in dark red-brown flat, needle-shaped crystals, irregular, coarse, granular masses, odorless, metallic, acid taste; permanent when pure, deliquescent when chloride present; melts at 27° C. (81° F.); soluble in water, alcohol. Aqueous solution acid; + silver nitrate T. S.—yellowish-white precipitate, insoluble in nitric acid, slightly soluble in ammonia water. Ignite .1 Gm., heat residue with nitric acid 5 cc., add distilled water 15 cc., evaporate filtrate, ignite—no weighable residue; contains 32 p. c. of gold. Alterative; diabetes, etc. Should be kept in amber-colored, glass-stoppered bottles. Dose, gr. $\frac{1}{20}$–$\frac{1}{5}$ (.003–.012 Gm.); 1. *Liquor Auri Bromidi et Arseni*—arsen. triox. .25 Gm., bromauric acid .325, bromine .4, aq. dest. q. s. 100 cc. Dose, ♏j–5 (.06–.3 cc.).

3. *Platinum*, $Pt^{ii-iv} = 195.2$. The element platinum (Sp. *platina*, dim. of *plata*, plate, silver—the two metals resemble in appearance), like gold, occurs mostly in the free state and in combination with iridium, osmium, palladium, rhodium, ruthenium, etc., metals resembling it; also in ores containing gold, lead, iron, silver; comes mainly from Ural Mountains and California. It is silvery white, soft like copper, malleable, ductile, possesses high fusing-point and great resistance to chemicals, soluble in nitrohydrochloric or nitrohydrobromic acid, good conductor of heat and electricity, sp. gr. 21.5; forms two series of compounds—*platinous*, $PtCl_2$, and *platinic*, $PtCl_4$.

1. *Platini Chloridum. Platinic Chloride*, $PtCl_4.5H_2O$.—Obtained by heating platinum 3 parts + hydrochloric acid 16 + nitric acid 7, evaporating nearly to dryness, redissolving in HCl, heating to expel HNO_3, evaporating to dryness; contains 46 p. c. of platinum. Seldom used in medicine, although the chloride has been employed with good results in constitutional syphilis in doses gr. $\frac{1}{8}$–$\frac{1}{2}$ (.008–.03 Gm.); the injection (1 p. c.) has been effective in leucorrhea, gleet, indolent ulcers. *Platinic Chloride Test Solution:* Chloroplatinic acid, $H_2PtCl_6.6H_2O$, 2.6 Gm. dissolved in 20 cc. distilled water.

PART IV.

ORGANIC CARBON COMPOUNDS.

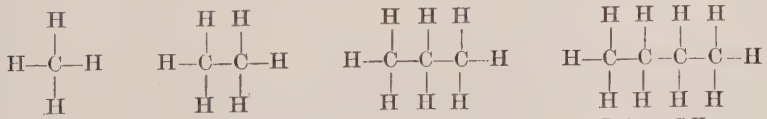
While the number of official preparations made from organic substances is small at present compared with the many that have gained medical favor, and while those accepted by the *U. S. Pharmacopœia* are most important and universally employed, yet it has been deemed wise to include here additionally a few that are scarcely secondary, and which may have a future recognition. So many, built artificially and synthetically, are but reproductions in strength, effect, medicinal properties, etc., of natural plant products, that we reasonably may expect a time when many such will replace, to a great extent, those from all other sources. As materia medica products are either inorganic or organic, and as the former comprise two great series: metals and metalloids, so the latter has two distinctive series: fatty and aromatic, consequently in this relationship-sequence they will be considered.

For a long time the term organic medicines was applied only to those agents taken directly from plants or animals—from a source built up of manifold varying organs in which alone was supposed to reside "vital force," by which all substances only could be created. We no longer hold to such restriction, because these very substances often are reproduced by a direct combination of the component elements or from apparent inorganic material which once was organic in nature.

Organic carbon compounds must contain, however, carbon and hydrogen, also frequently oxygen, nitrogen, sulphur. Such elements so differ from each other in chemical and physical properties, while their combining quantities are so unrestricted, that they unite in varying proportions to yield many hundred substances, each differing somewhat from the other.

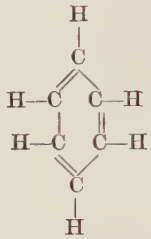
Carbon, being quadrivalent, is considered the graphical center around which the other elements are arranged—linked as it were by a bond dependent, as to strength and degree, upon each element's atomic valence. The grouping of these carbon atoms in a molecule is quite different in the two organic series.

I. Fatty Series: Derivatives of methane, CH_4, and are linked so as to form an open chain in which the end carbon atoms are not equivalent to the others:



Methane, CH_4 — Ethane, C_2H_6 — Propane, C_3H_8 — Butane, C_4H_{10}

II. Aromatic Series: Derivatives of benzene (benzol), C_6H_6, and are linked to form a closed chain in which every carbon atom is the equivalent of each other. This chain (skeleton) has been assumed from the fact that as soon as 6 or more carbon atoms come together they tend so to unite as to form stable and permanent compounds into which only definite amounts of other elements can be introduced.



Benzene, C_6H_6

Thus benzene takes up 2–4–6 atoms of hydrogen, chlorine, bromine, and under the prolonged action of HI becomes C_6H_{12}, and no more H can be imparted even if the action be continued indefinitely, whereas if carbon atoms were in open chain we would get C_6H_{14}, etc. Then, again, when the hexa-chloride or bromide of benzene is formed, each refuses to take up any more of either element, thus showing roundness or entireness in saturation and composition.

I. FATTY SERIES.

I. Hydrocarbons.

These compounds contain the elements carbon and hydrogen in various proportions, are mostly of vegetable origin, many being obtained by destructive distillation and decomposition of organic matter, and all have different boiling-points, by which it is possible to isolate them when carefully distilled fractionally. They are either gases, liquids, or solids, according to the number of carbon atoms in the molecule: 1–4 –gas, 4–10–12—liquid, and beyond this—solid; they can all be volatilized without decomposition, are colorless, usually with characteristic odor, neutral, soluble in alcohol, ether, carbon disulphide, insoluble in water, some oxidize by exposure, the liquids often becoming solids.

Benzinum Purificatum. Purified Petroleum Benzin, $C_5H_{12} + C_6H_{14} +$, *U.S.P.* –(Syn., Benzin. Purif., Petroleum Ether; Fr. Ether de Pétrole purifié; Ger. Gereinigter Petroläther.)

Manufacture: Purified petroleum benzin (*benz*(oic) + *in*—odor somewhat benzoin-like) is a purified distillate from American petroleum consisting of hydrocarbons, chiefly of the methane series, $C_5H_{12} + C_6H_{14} +$, and may be obtained by mixing sulphuric acid (6 cc.) and water (55), adding when cold potassium permanganate (.8 Gm.)

and, after it is dissolved, petroleum benzin (100 cc.) in 4 portions, shaking after each; let stand 24 hours, shaking frequently, decant petroleum benzin and add to it potassium permanganate (.2 Gm.) dissolved in water (24 cc.) containing sodium hydroxide (.2 Gm.), agitate frequently, repeat washing with water, decant purified petroleum benzin. It is a clear, colorless, non-fluorescent, volatile liquid, ethereal, faint petroleum-like odor, neutral, highly inflammable vapor mixed with air and ignited—explodes violently, insoluble in water, freely soluble in alcohol, miscible with ether, chloroform, benzene, volatile or fixed oils (except castor oil), sp. gr. 0.650, distils at 35°–80° C. (95°–176° F.). *Tests:* 1. Evaporate from filter paper 10 cc.—no greasy stain, no disagreeable sulphuretted odor. 2. Evaporate 50 cc. —residue from 50 cc. .001 Gm. *Impurities:* Benzene, pyrogenous products, sulphur compounds—which the process is intended to remove. Should be kept carefully cool, remote from fire, in well-closed containers. Dose, ℥x–20 (.6–1.3 cc.), emulsion, capsule, on sugar.

Allied Products:

1. *Benzinum. Petroleum Benzin*, $C_5H_{12} + C_6H_{14}+$, U.S.P. 1870–1900. —Obtained by subjecting crude petroleum to fractional distillation, when benzin (naphtha), illuminating oils, and a residuum largely composed of paraffin are produced—that part collected at 45–60° C. (113–140° F.) being the once official product. It is a transparent, colorless, diffusible liquid, strong characteristic odor of petroleum, but less disagreeable, corresponding to tests and reactions as above.

Properties and Uses.—Internally—vermifuge; Externally—sedative, anesthetic, solvent; tapeworm, scabies, prurigo, herpes, favus, sycosis, rheumatism, neuralgia, to relieve itching in urticaria, whooping-cough. Like creosote and phenol (carbolic acid) to restrain fermentation in dyspepsia. Good solvent for fats, volatile oils, resins, caoutchouc, alkaloids, etc.

Petrolatum Liquidum. Liquid Petrolatum, *U.S.P.*—(Syn., Petrolat. Liq., Liquid Paraffin, White Mineral Oil, Paraffin Oil, Liquid (Cosmoline) Vaseline; Br. Paraffinum Liquidum, Liquid Paraffin; Fr. Huile de Paraffine; Ger. Flüssiges Paraffin, Paraffinöl.)

Manufacture: Liquid petrolatum (L. *petra;* Gr. πέτρα, rock, + L. *oleum;* Gr. ἔλαιον, oil—rock oil) is a mixture of liquid hydrocarbons, chiefly of the methane series, obtained by distilling off most of the lighter and more volatile portions from petroleum (a substance found in wells, on surface of streams, and oozing from the ground in Pennsylvania, New York, Ohio, etc.), and purifying the liquid residue—the portion going over at 330–390° C. (626–734° F.) being treated with sulphuric acid, then with caustic alkali, filtered (hot) through animal charcoal, cooled to remove solid paraffins (which crystallize out), collecting and reserving that fraction distilling above 360° C. (626° F.). There are two varieties: 1. *Heavy Liquid Petrolatum*—kinematic viscosity not less than .381, sp. gr. 0.828–0.905; at 0° C. (32° F.) not

more than opalescent (abs. of solid paraffins); 2. *Light Liquid Petrolatum*—kinematic viscosity not more than .370, sp. gr. 0.828–0.905; at 0° C. (32° F.) not more than opalescent (abs. of solid paraffins). Each is a colorless, transparent, oily liquid, free, or nearly free, from fluorescence, odorless, and tasteless when cold, faint petroleum odor when heated; soluble in ether, chloroform, petroleum benzin, fixed or volatile oils, insoluble in water, alcohol; dissolves camphor, menthol, thymol, and many similar substances. *Impurities:* Acids, alkalies, sulphur compounds, carbonizable substances, solid paraffins. Should be kept dark, in well-closed containers. Dose, ʒij–8 (8–30 cc.).

Preparations.—1. *Nebula Aromatica, N.F.*, light petrolat. liq. q. s. 100. 2. *Nebula Eucalyptolis, N.F.*, light petrolat. liq. q. s. 100. 3. *Nebula Mentholis, N.F.*, light petrolat. liq. q. s. 100. 4. *Nebula Mentholis Composita, N.F.*, light petrolat. liq. q. s. 100. 5. *Nebula Thymolis, N.F.*, light petrolat. liq. q. s. 100. 6. *Pasta Resorcinolis Fortis, N.F.*, light petrolat. liq. q. s. 100 (40). 7. *Pasta Resorcinolis Mitis, N.F.*, light petrolat. liq. q. s. 100 (40). 8. *Petroxolinum Liquidum, N.F.*, light petrolat. liq. 58 cc., acid. oleic. 30, aq. ammon. fort. 5, ol. lavand. ½, alcohol q. s. 100 cc.

Preps.: 1. *Petroxolinum Betanaphtholis, N.F.*, q. s. 100. 2. *Petroxolinum Bituminis Sulphonati, N.F.*, q. s. 100. 3. *Petroxolinum Cadinum, N.F.*, q. s. 100. 4. *Petroxolinum Chloroformi Camphoratum, N.F.*, q. s. 100. 5. *Petroxolinum Eucalyptolis, N.F.*, q. s. 100. 6. *Petroxolinum Guaiacolis, N.F.*, q. s. 100. 7. *Petroxolinum Iodi, N.F.*, q. s. 100. 8. *Petroxolinum Iodi Dilutum, N.F.*, q. s. 100. 9. *Petroxolinum Mentholis, N.F.*, q. s. 100. 10. *Petroxolinum Methylis Salicylatis, N.F.*, q. s. 100. 11. *Petroxolinum Phenolis, N.F.*, q. s. 100. 12. *Petroxolinum Phenolis Camphoratum, N.F.*, q. s. 100. 13. *Petroxolinum Sulphuratum, N.F.*, q. s. 100. 14. *Petroxolinum Sulphuratum Compositum, N.F.*, q. s. 100.

9. *Petroxolinum Spissum, N.F.*, light petrolat. liq. 20 Gm., white wax 35, oleic acid 32, ol. lavand. 3, alcohol 5, aq. ammon. fort. 5.

Petrolatum. **Petrolatum**, $C_{16}H_{34}$ +, *U.S.P.*—(Syn., Petrolat., Amber Petrolatum, Petroleum Jelly, Petrolatum Ointment, Petrolatum (Mollé) Spissum, Vaseline, Cosmoline, Soft Paraffin; Fr. Petroleine; Ger. Unguentum Paraffinum, Paraffin (salbe) butter.)

Manufacture: A purified, semi-solid mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue. It is an unctuous mass, yellowish, light amber, slight fluorescence, even when melted, transparent in thin layers, free, or nearly free from odor and taste; soluble in ether, chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene, most fixed and volatile oils, insoluble in water, almost insoluble in cold or hot alcohol, or cold dehydrated alcohol, sp. gr. 0.820–0.865, melts at 38–54° C. (100–129° F.).

Tests: 1. Heat 2 Gm. in open dish over flame—volatilizes without acrid odor; incinerate—ash .05 p. c. 2. Melt, shake with equal vol. of hot distilled water—latter neutral (abs. of acids, alkalies). 3. Digest 10 Gm. for half an hour at 100° C. (212° F.) with sodium hydroxide 10 Gm. + distilled water 50 cc., separate and supersaturate aqueous layer with sulphuric acid—no oily or solid substance separates (abs. of fixed oils, fats, rosin). *Impurities:* Acids, alkalies, fixed oils, fats, rosin.

PREPARATIONS.—1. *Unguentum Acidi Borici*, 85 p. c. 2. *Unguentum Belladonnæ*, 50 p. c. 3. *Unguentum Hydrargyri Mite*, 20 p. c. 4. *Unguentum Hydrargyri Oxidi Flavi*, 88 p. c. 5. *Unguentum Iodoformi*, 70 p. c. 6. *Unguentum Phenolis*, 93 p. c. 7. *Unguentum Picis Pini*, 35 p. c. 8. *Emulsum Petrolati., N.F.*, 22.5 p. c. + expressed oil of almond 22.5, acacia 12.5, syrup 10, tr. lemon peel 1.5, water q. s. 100 cc. 9. *Pasta Betanaphtholis, N.F.*, 20 p. c. 10. *Pasta Zinci, N.F.*, 50 p. c. 11. *Unguentum Bituminis Sulphonati, N.F.*, 90 p. c. 12. *Unguentum Capsici, N.F.*, 85 p. c. 13. *Unguentum Hydrargyri Oxidi Rubri, N.F.*, 40 p. c. 14. *Unguentum Iodi Denigrescens, N.F.*, 70 p. c. 15. *Unguentum Resorcinolis Compositum, N.F.*, 25 p. c.

Unoff. Prep.: Unguentum Paraffini (Br.), hard paraffin 27 Gm., soft paraffin 70, white wax 3.

Petrolatum Album. White Petrolatum, *U.S.P.*—(Syn., Petrolat. Alb., White Petroleum Jelly, Paraffinum Album, White (Vaseline, Cosmoline) Paraffin, Refined (Paraffin) Petrolatum; Fr. Vaséline blanc; Ger. Weisses Vaselin.)

Manufacture: Petrolatum wholly or nearly decolorized, being a colorless mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue. It is a white, faintly yellowish unctuous mass, transparent in thin layers even after cooling to 0° C. (32° F.)—otherwise similar to petrolatum.

PREPARATIONS.—1. *Unguentum Hydrargyri Ammoniati*, 40 p. c. 2. *Unguentum Plumbi Oleatis*, 49 p. c. 3. *Unguentum Zinci Oxidi*, 65 p. c. 4. *Ceratum Camphoræ, N.F.*, 15 p. c. 5. *Ceratum Plumbi Subacetatis, N.F.*, 38 p. c. 6. *Curatio Paraffini, N.F.*, 12 p. c. 7. *Unguentum Hydrargyri Chloridi Mitis, N.F.*, 70 p. c. 8. *Unguentum Zinci Stearatis, N.F.*, 50 p. c.

PROPERTIES AND USES.—Petrolatum in its three forms is a bland, neutral, protective dressing and a substitute for fatty substances in ointments; large doses, mild laxative, soothing internal irritation and inflammation. Liquid form largely used in spray, being a good vehicle and solvent for many medicinal agents, applicable to mucous membranes of bronchi, larynx, nose, throat; also in constipation when feces dry and hard; for lubricating purposes. None becomes rancid, and all are absolutely non-irritating. Workmen employed in its manufacture never are troubled with chronic bronchitis or phthisis.

Allied Products:

1. *Bitumen Sulphonatum. Sulphonated Bitumen, N.F.*—A thick blackish, viscous fluid containing not less than 2.5 p. c. ammonia, 10 p. c. of sulphur, not more than 8 p. c. ammonium sulphate. Obtained by the destructive distillation of certain European (Tyrol) bituminous schists containing petrified fossil remains of fish and other animals; this crude oil is now saturated with sulphuric acid and becomes heated to 100° C. (212° F.), forming ichthyl-sulphonic acid with the evolution of sulphur dioxide; it is next treated with NaOH (or NaCl) solution, to remove H_2SO_3 and H_2SO_4, and residue saturated with ammonia. It is a brownish-black viscous fluid, strong characteristic empyreumatic odor; soluble in water, glycerin, miscible with fixed oils and fats, freely soluble in alcohol, ether, and in equal volumes of the two mixed. Aqueous solution (1 in 10) faintly acid, or alkaline, + hydrochloric acid—precipitates dark resinous mass soluble in ether; aqueous solution boiled with sodium hydroxide T. S.—ammonia evolved; ash .5 p. c.; upon drying—loses 50 p. c. Alterative, anodyne, discutient, antiseptic—fatal to staphylococci, streptococci, etc.; chronic rheumatism, gout, lepra, eczema, urticaria, acne, intertrigo, lupus, ulcers, lymphatic enlargements, burns, frost-bites, sprains, contusions, psoriasis, prostatitis. Dose, gr. 10–20 (.6–1.3 Gm.) ter die, in pill; ointment 20–50 p. c. with wool fat; 1. *Collodium Bituminis Sulphonati*, 10 p. c. + collod. flex. q. s. 100; 2. *Petroxolinum Bituminis Sulphonati*, 10 Gm. in 100 cc. product; 3. *Unguentum Bituminis Sulphonati*, 10 p. c. + petrolatum 90.

Sodium-sulpho-ichthyolate is the most important salt for administering in pill-form, although we have the corresponding salts of lithium, zinc, and mercury, each being obtained by saturating the acid with the respective oxides or carbonates.

2. *Bitumen. Bitumen*, U.S.P. 1820.—This was the crude petroleum (L. *petra*, rock, + *oleum*) as found in various places (North America, England, Scotland, West Indies) under the names naphtha, petroleum, oleum gabearium, Seneca oil, Barbados tar (naphtha), Trinidad pitch, etc. Formerly was used as we now use petroleum; upon distillation have residue left in still, termed solid bitumen or asphaltum.

3. *Rhigolene.*—Obtained from petroleum by redistillation until a liquid is secured boiling at 18° C. (64.4° F.). It evaporates more rapidly than all known liquids (except cymogene, which boils at 0° C. (32° F.)), and when atomized gives a temperature of —9° C. (15.8° F.). Used to produce local numbness, or freezing, for minor operations by cautery, etc.

Paraffinum. Paraffin, *U.S.P.*—(Syn., Paraff.; Br. Paraffinum Durum, Hard Paraffin; Fr. Paraffine; Ger. Paraffinum solidum, Zeresin, Festes Paraffin, Gereinigtes Erdwachs.)

Manufacture: This is a purified mixture of solid hydrocarbons, chiefly of the methane series, usually obtained by chilling and pressing

the distillates from petroleum having high boiling-points, and purifying the solid press cake so obtained. Paraffins are formed from fats and other organic compounds, but chiefly result from destructive distillation of bituminous shale, etc., found as natural constituent in petroleum and in minerals known as mineral wax, earth-wax, and ozokerite. The tarry oil of shale is distilled, giving a residue of coke and asphalt; treat distillate with sulphuric acid, then with sodium hydroxide (to remove olefins, phenols), wash product, redistil, and after recovery of lighter hydrocarbons and lubricating oils, the remaining thick oil upon cooling separates paraffin; dissolve crude paraffin in petroleum or naphtha, again separate by refrigeration and pressure, melt, decolorize by filtering through animal charcoal. It is a colorless, white, more or less translucent mass, frequently showing a crystalline structure, slightly greasy to the touch, odorless, tasteless, soluble in ether, petroleum benzin, benzene, carbon disulphide, volatile oils, most warm fixed oils, slightly in dehydrated alcohol, insoluble in water or alcohol, sp. gr. 0.900, melts at 54° C. (129° F.), strongly heated ignites, burning with luminous flame depositing carbon; contains chiefly $C_{24}H_{50}$ and $C_{27}H_{56}$. *Tests:* 1. Heat .5 Gm. with equal weight of sulphur—mixture black from separated carbon, and hydrogen sulphide gas is evolved. 2. Not acted upon or colored by strong sulphuric or nitric acid in the cold; when melted and shaken with an equal volume of hot alcohol—latter does not redden moistened blue litmus paper (abs. of acids).

PREPARATIONS.—1. *Tinctura Opii,* 5 p. c. 2. *Unguentum Zinci Oxidi,* 15 p. c. 3. *Curatio Paraffini, N.F.,* 82 p. c. + resorcinol 1, oil of eucalyptus 2, olive oil 3, white petrolatum 12. 4. *Unguentum Capsici, N.F.,* 10 p. c. 5. *Unguentum Iodi Denigrescens, N.F.,* 5 p. c.

PROPERTIES AND USES.—Protective, emollient; preserves lemons, meat, etc., when coated with thin film, makes paper impervious to moisture, lubricator, chewing gum, to adulterate candies, chocolate, coat pills, bottles, jars, boxes, to correct deformities (nose, breast, etc.) by heating and injecting into tissues and cavities; ointments, candles.

Paraffinum Chlorinatum. Chlorinated Paraffin, *U.S.P.*—(Syn., Paraff. Chlorinat., Chlorcosane.)

Manufacture: Pass chlorine into melted paraffin, maintained at 125–140 C. (257–284° F.), until weight has increased 50 p. c., while warm agitate liquid with 5 p. c. of its weight of dry sodium carbonate. It is a light yellow, light amber, clear, neutral, thick, oily liquid, odorless, stable, insoluble in water, slightly soluble in alcohol, miscible with benzene, carbon tetrachloride, chloroform, ether; sp. gr. 1.040; ash .1 p. c. *Tests:* 1. Boil for 30 minutes 5 drops with 10 cc. alcoholic potassium hydroxide T. S. under reflux condenser, cool, add distilled water 10 cc., acidulate with diluted nitric acid—liquid turbid from separation of small oily drops; shake mixture with equal volume ether, let liquid separate, draw off clear aqueous layer, add few cc. silver nitrate T. S.—white precipitate. *Impurities:* Acids, alkalies, chloride, free chlorine.

Properties and Uses.—Antiseptic, disinfectant: means of applying dichloramine, which is rapidly decomposed by liquid petrolatum, unless previously saturated with chlorine, owing to its great affinity for that element. It is too viscid for nebulizers, consequently must be rendered more fluid by carbon tetrachloride or eucalyptol.

II. Alcohols.

These are hydrocarbon residues in combination with hydroxyl, OH, or hydrocarbons in which one or more hydrogen atoms have been replaced by hydroxyl, if 1 = monatomic, 2 = diatomic, 3 = triatomic, 4 = tetratomic alcohols, etc. They are hydroxides of the organic radicals or residues, as thus shown:

CH_3OH	C_2H_5OH	C_3H_7OH	C_4H_9OH	$C_5H_{11}OH$	$C_3H_5(OH)_3$.
Methyl Alcohol.	Ethyl Alcohol.	Propyl Alcohol.	Butyl Alcohol.	Amyl Alcohol.	Glycerin.

Here methane, CH_4, is converted into methyl, CH_3, which combines with hydroxyl, OH, to form methyl alcohol. Ethane, C_2H_6, is converted into ethyl, C_2H_5, which unites with OH to form ethyl alcohol, etc.

1. Monatomic Alcohols.

Alcohol. Alcohol. C_2H_5OH, *U.S.P.* —(Syn., Ethanol, Alcohol Vini, Spirit of Wine, Common (Ethyl) Alcohol, Spiritus Vini Rectificatissimus; Br. Spiritus Rectificatus, Rectified Spirit; Fr. Alcool, Esprit de Vin; Ger. Spiritus, (Rectificirter) Weingeist.) A liquid composed of 92.3 p. c. by weight, or 94.9 p. c. by volume, of ethyl alcohol, C_2H_5-OH, and 7.7 p. c. by weight of water.

Manufacture: 1. From ethene, C_2H_4, by adding the elements of water, which can be done by shaking with sulphuric acid —(1) $C_2H_4 + H_2SO_4 = C_2H_5HSO_4$. (2) $C_2H_5HSO_4 + H_2O$ + distillation = C_2H_5-OH + H_2SO_4. 2. Obtained on a large scale by the mashing process —fermenting (with yeast, etc.) certain weak saccharine solutions containing grape-sugar or glucose—$C_6H_{12}O_6$ + ferment = $2C_2H_5OH + 2CO_2$. In actual practice, grain, such as barley, corn, rye, wheat, is malted or germinated. Here the starch is acted on by the contained ferment (diastase), converting it into maltodextrin and maltose and finally into dextrose, apparently by the simple appropriation of water —$3C_6H_{10}O_5$ (starch) + $H_2O = C_6H_{10}O_5$ (dextrin) + $C_{12}H_{22}O_{11}$ (maltose) $C_6H_{10}O_5 + C_{12}H_{22}O_{11} + H_2O = 3C_6H_{12}O_6$ (dextrose). This will be transformed into other products if germination be allowed to go on, but prior to that resulting (when acrospire is about one-third the length of the grain, and maximum amount of diastase is present), the sprouted grain is roasted, ground, then infused in warm water, thus forming *mash*, and the yielded dextrose solution, *wort*, fermented by yeast. This fermented liquid, *wash*, contains water, fusel oil, glycerin, succinic acid, and never more than 14 p. c. alcohol, as the yeast plant is unable to live in a fluid of greater strength. By first distillation get *low wine*

(about 20 p. c. alcohol), and by second distillation a liquid much richer in alcohol—*raw whisky*, which treated with charcoal, redistilled and vapors passed through a series of condensers gives a product free from water and other impurities—the final traces of these being removed by redistillation over sodium manganate, anhydrous sodium acetate (2 p. c. for odor), and freshly burned lime. It is a transparent, colorless, mobile, volatile liquid; slight characteristic odor, burning taste; miscible with water (without cloudiness), also ether and chloroform; neutral; sp. gr. 0.816; boils at 78° C. (178° F.). *Tests:* 1. Inflammable —burns with bluish smokeless flame. 2. Evaporate 40 cc.—residue .001 Gm. *Impurities:* Fusel oil constituents, amyl alcohol, nonvolatile carbonizable organic bodies, aldehyde, formaldehyde, acetone, oak tannin, methanol, alkaloids, diethylphthalate, isopropyl alcohol, phenols. Should be kept cool, remote from fire, in well-closed containers.

PREPARATIONS.—1. *Alcohol Dilutum.* Diluted Alcohol. (Syn., Alcohol Dil., Diluted Ethanol, Proof Spirit; Fr. Alcool dilué; Ger. Spiritus dilutus (Vini Rectificatus), Verdünnter Weingeist.) A liquid containing 41–42 p. c. by weight, or 48.4–49.5 p. c. by volume, of C_2H_5OH.

Manufacture: 1. Alcohol 50 cc., distilled water 50 cc., when mixed and cooled will measure 97 cc. 2. Alcohol 40.8 Gm., distilled water 50 Gm. It has sp. gr. 0.936; should respond to alcohol tests, and be kept cool, remote from fire, in well-closed containers.

2. *Alcohol Dehydratum.* Dehydrated Alcohol. (Syn., Alcohol Dehyd., Alcohol Absolutum, Dehydrated Ethanol, U.S.P. 1900, Alcohol Ethylicum; Fr. Alcool Absolu; Ger. Alcohol absolutus, Absolutor Alkohol.) A liquid containing 99 p. c. by weight of C_2H_5OH.

Manufacture: Percolate the strongest and purest alcohol through recently burned lime, out of contact with air, redistil the percolate *in vacuo*. It is a transparent, colorless, mobile, volatile liquid; characteristic odor; burning taste, very hygroscopic, sp. gr. 0.798. *Tests:* 1. Shake 10 cc. with powdered anhydrous cupric sulphate .5 Gm.—latter not blue (abs. of water). Should respond to alcohol tests, and be kept cool, remote from fire, in well-closed containers.

Related Products:

1. *Spiritus Frumenti. Whisky, U.S.P.*—(Syn., Fr. Eau de Vie de Grains; Ger. Kornbranntwein.)

Manufacture: An alcoholic liquid obtained by the distillation of the fermented mash of wholly or partly malted cereal grains (rye, wheat, barley, Indian corn, sometimes oats and potatoes). The infusion is fermented as in making alcohol, by which the sugars, and indirectly the starch are converted into alcohol and carbon dioxide; the resulting liquid is distilled, yielding a low wine, which upon redistillation produces a stronger and purer spirit containing less fusel oil, known as raw spirit. This should be kept in charred containers (barrels) for at least 4 years, to become mellow and produce the aroma and flavor by the formation of esters (aging). Before being used it is colored

(caramel) and should be diluted, as aging causes an increased alcoholic strength due to loss of water to a greater extent than loss of alcohol. It is a light to deep amber-colored liquid, characteristic odor and taste, acid reaction; sp. gr. 0.929, corresponding to an alcoholic strength of 47–53 p. c. by volume at 15.56° C. (60° F.). *Tests:* 1. Evaporate 20 cc.—residue not completely soluble in distilled water 5 cc.; filtered solution + 1 drop of diluted ferric chloride T. S. (1 in 10) –greenish-black color (ind. storage in wood barrels). 2. Add 2 cc. sodium hydroxide T. S. to 5 cc. of a fresh distillate, + 5 drops of freshly prepared aqueous solution of sodium nitroprusside (1 in 50), + slight excess of acetic acid –no violet tint in 1 minute (abs. of acetone). 3. Add to 10 cc. diluted hydrochloric acid 5 drops, evaporate to 5 cc., add distilled water 10 cc., add to filtrate iodine T. S. or mercuric potassium iodide T. S.—no precipitate (abs. of alkaloids). 4. Mix 2 cc. of aqueous solution of phloroglucinol (1 in 100) with 5 cc. sodium hydroxide T. S., add whisky 2 cc.—no red color (abs. of formaldehyde). *Impurities:* Acetone, methanol, alkaloids, caramel, diethylphthalate, formaldehyde, glycerin, sugar, heavy metals, isopropyl alcohol, esters, phenols.

2. *Spiritus Vini Vitis. Brandy, U.S.P.*—(Syn., Sp. Vin. Vit.; Spiritus Vini Gallici; Spirit of French Wine; Fr. Eau de Vie, Cognac; Ger. Spiritus e Vino, Weinbrannd, Spiritus vini Cognac, Franzbranntwein, Branntwein.)

Manufacture: An alcoholic liquid obtained by the distillation of the fermented juice of sound, ripe grapes. When the juices of fruits are fermented, and the resulting liquid (wine) from the *marc* is distilled—the distillate is brandy, giving us a number, named according to the fruit used: grape, apple, pear, peach, etc. It is that of grapes, however, which is official and recognized throughout the world under the name of brandy. The best is from the grape wines of France, produced in the districts of Cognac, Armagnac, Bordeaux, Rochelle, etc. Good brandies are also produced in Spain, Portugal, Germany and United States—Catawba and California being considered our best. Brandy is a pale, amber-colored liquid, characteristic odor and taste, acid reaction; sp. gr. 0.927, corresponding to an alcoholic strength of 48–54 p. c. by volume at 15.56° C. (60° F.). Brandy must have been kept in wood containers (barrels) for at least 4 years for the purpose of ester formation (aging). *Tests:* 1. Evaporate 20 cc. on water-bath—residue .3 Gm. 2. Slowly distil 20 cc. of a mixture of brandy 20 + water 5—distillate meets the requirements of whisky for acetone and methanol. 3. Brandy meets the requirements of the tests for purity under whisky beginning with that for alkaloids (except caramel, glycerin, sugar, etc.). *Impurities:* Fusel oil, added sugar, acetone, formaldehyde, methanol, free acid, etc.).

Preparation.—(Unoff.): *Mistura Spiritus Vini Gallici* (Br.), 42 p. c., dose, ʒs–2 (30–60 cc.).

3. *Vinum Album. White Wine*, U.S.P. 1850–1900. See page 394, *Vinum Xericum. Sherry Wine*, U.S.P. 1820–1870.—Formerly selected as the representative to be used whenever white wine was desired; sp. gr. 0.978–0.995; alcoholic strength 18–22 p. c.

4. *Vinum Rubrum. Red Wine*, U.S.P. 1850, 1880–1900. See page 395, *Vinum Portense. Port Wine*, U.S.P. 1850–1870.—Formerly selected as the representative to be used whenever red wine was desired; it is from the grape cultivated near the river Douro, in Portugal, being exported from Oporto; alcoholic strength 18–22 p. c.

5. *Alcohol Amylicum. Amyl (Amylic) Alcohol*, $C_5H_{11}OH$, U.S.P. 1860–1870.—This is produced during the alcoholic fermentation of grain, and especially potatoes, the great bulk passing over with the last portions of the first distillation which are milky and contain additionally varying amounts of ethyl (20–30 p. c.), propyl and isobutyl alcohols, water, pyridin, furfurol, ethers, etc., differing with the fusel oil source. To purify wash with strong solution sodium chloride or calcium chloride, distil washed residuum, collecting that coming over at 128–131° C. (262–268° F.). It is an oily colorless liquid, penetrating oppressive odor, burning acrid taste, sp. gr. 0.818, boils at 132° C. (269° F.), congeals at—134° C. (—209° F.), soluble in alcohol, insoluble in water. Does not take fire like alcohol, requiring heating to 55° C. (131° F.) before igniting. When treated with an oxidizing agent 2 atoms of H are replaced by 1 of O, giving $C_5H_{10}O_2$, which is amylic or valeric (valerianic) acid, this being the method of obtaining nearly all of this acid.

Properties and Uses.—Alcohol in its various forms is stimulant, depressant, diuretic, astringent, disinfectant, antipyretic, rubefacient, diaphoretic; stimulates heart muscle, causing rapid and strong beats, dilates peripheral bloodvessels, stimulates brain by increasing blood supply; before meals improves appetite, during meals retards digestion by checking flow of gastric juice and increasing secretion of mucus, moderate amounts serve as a food, being oxidized during circulation; lessens waste of tissues; externally refrigerant, rubefacient. It is rapidly absorbed and eliminated by kidneys, lungs, skin, and liver. Internally —debility, typhoid and other low fevers, pyemia, pneumonia, erysipelas, after shocks, fatigue, prolonged sickness, syncope, delirium, febrile stupor, tremor, eruptive and relapsing fevers, consumption, delirium tremens, poisoning by serpents, narcotics, etc., tetanus, epilepsy, reflex convulsions (as in dentition), vomiting of pregnancy, neuralgia. Externally—wounds, abscesses, aneurisms, gangrenous and other ulcers, nipple fissures, sore feet, bruises, sprains, paralyzed limbs, nasal polypi, soft tumors, varicocele. As an anesthetic to diminish shock of surgical operation, to facilitate reduction of dislocation. Alcohol—in pharmacy is quite indispensable by reason of its extractive and preservative powers; also useful to preserve animal tissue, and in the arts. Whisky—is an excellent stimulant, does not constipate like brandy, and is preferred generally. Used also as an antiseptic in

wounds, ulcers, etc. Brandy—on the other hand, is more grateful to the stomach, more palatable, and less apt than whisky, gin, etc., to cause liver or kidney diseases. It is much used in low fevers, with milk, flavored to the patient's taste. White and Red Wines—tonic in convalescence, excessive discharge of blood, prolonged suppuration, etc. Amyl alcohol—poisonous, and should be given cautiously as a nervous stimulant, in phthisis; chiefly used to make amyl nitrite, fruit essences (ester), sodium valerate, and valeric acid.

Poisoning: Have confused mind, giddiness, muscular relaxation, hallucinations, stupor, coma, rapid, weak pulse, cool, moist skin, dilated pupils, noisy breathing, livid lips; usually can arouse for a short time. Continued abuse may produce chronic gastritis, liver cirrhosis, gout, peripheral neuritis, delirium tremens, mania, Bright's disease, predisposes to phthisis, and lessens resistance to pneumonia and surgical operations. When acute, empty stomach by mustard, hypodermic apomorphine, or pump, washing it out well with strong warm coffee, plenty fresh air, inhale ammonia, give aromatic spirit of ammonia, coffee, capsicum, vinegar, hot milk, apply cold water to head, warmth to body and extremities, electricity. In delirium may quiet with chloral hydrate, potassium bromide, opium, follow with digitalis, strychnine, possibly gastric sedatives (bismuth subnitrate, phenol (carbolic acid), etc.).

2. Triatomic Alcohols.

Glycerinum. Glycerin, $C_3H_5(OH)_3$, *U.S.P.*—(Syn., Glycerol, Glycerine, Glycerina; Fr. Glycérine; Ger. Glyzerin, Glyceryloxyhydrate, Oelsüss, Scheeleches Süss.)

Manufacture: Glycerin (Gr. γλυκερός, γλυκύς, sweet—its taste) is obtained by the hydrolysis of vegetable or animal fats, or fixed oils, and purified by steam distillation; when these are acted upon (decomposed) by an alkali, this latter unites with the fatty acids, forming soap, and liberates glycerin:

$$\underset{\substack{\text{Glyceryl Oleate}\\\text{(Olive Oil).}}}{C_3H_5(C_{18}H_{33}O_2)_3} + 3NaOH = \underset{\substack{\text{Glyceryl}\\\text{Hydroxide}\\\text{(Glycerin).}}}{C_3H_5(OH)_3} + \underset{\substack{\text{Sodium Oleate}\\\text{(Hard Soap).}}}{3NaC_{18}H_{33}O_2.}$$

It is a clear, colorless, syrupy liquid, slight, characteristic odor which is neither harsh nor disagreeable; sweet taste, with the sensation of warmth in the mouth; absorbs moisture on exposure; miscible with water, alcohol; insoluble in chloroform, ether, benzene, petroleum benzin, carbon disulphide, fixed or volatile oils; aqueous solution (1 in 20) neutral, sp. gr. 1.249; contains 95 p. c. of the triatomic alcohol, $C_3H_5(OH)_3$. *Tests:* 1. Heat a few drops with .5 Gm. of potassium bisulphate—pungent vapors of acrolein evolved; ash—.007 p. c. 2. Add to 5 cc., sulphuric acid 5, shake 1 minute, allow to stand 1 hour—not darker than yellow (abs. of readily carbonizable substances). 3. Aqueous solution (1 in 10), 10 cc. portions—remains clear + .5 cc. calcium chloride T. S., (abs. of oxalate); + .5 cc. silver nitrate T. S.

(abs. chloride); + 3 drops of diluted hydrochloric acid and 5 drops of barium chloride T. S. (abs. of sulphate). 4. Add to 5 cc. an aqueous solution of potassium hydroxide (1 in 10) 5 cc.—not yellow in 5 minutes when kept at 60° C. (140° F.) (abs. of acrolein, glucose), nor does it emit odor of ammonia (abs. of ammonium compounds). *Impurities:* Heavy metals, arsenic, ammonium compounds, acrolein, glucose, fatty acids and esters, oxalate, chloride, sulphate, readily carbonizable substances. Dose, ♏x–60 (.6–4 cc.).

Preparations.—1. *Suppositoria Glycerini.* Suppositories of Glycerin. (Syn., Supp. Glycerin.; Br. Glycerin Suppositories; Fr. Suppositoires de Glycerin; Ger. Glycerin Suppositorien (Stuhlzäpfchen).)

Manufacture: Dissolve monohydrated sodium carbonate 2 Gm. in water 10 cc., add it to glycerin 80 Gm., in suitable vessel well down in the boiling water of water-bath and contents protected from steam of bath, add stearic acid 8 Gm., heat for 15 minutes, until all carbon dioxide evolved and liquid clear; pour into 30 molds, cool. Should be kept cool, in tightly-stoppered glass vessels.

2. *Gelatinum Glycerinatum,* 50 p. c. 3. *Glyceritum Acidi Tannici,* 79 p. c. 4. *Glyceritum Amyli,* 70 p. c. 5. *Glyceritum Boroglycerini,* 96 p. c. 6. *Glyceritum Phenolis,* 79 p. c. 7. *Suppositoria Boroglycerini, N.F.,* 1¼ Gm. each. 8. *Cataplasma Kaolini, N.F.,* 38.7 p. c. 9. *Solvent, Preservative*—Elixirs, Fluidextracts, Fluidglycerates, Glycerites, Liquors, Ointments, Pills, Tinctures, etc.

Properties and Uses.—Irritant, laxative, solvent, emollient when diluted. Externally—skin diseases (eczema, herpes, lepra, pityriasis, psoriasis, lichen, prurigo); in lotion for incrusted lupus, chapped skin (diluted), excoriated surfaces, fissures of anus and nipple, wounds, boils, carbuncles, abscesses, coryza, pharyngitis, otorrhea; allays itching, dryness of mouth, deafness. Internally—phthisis, diabetes, typhoid fever, constipation, in enemas or suppositories, ascarides, dysentery, hemorrhoids, leucorrhea. In pharmacy as a solvent (iodine, bromine, tannin, alkaloids, salicin, alkalies, etc.), vehicle, excipient, preservative, to keep extracts soft and from molding, etc. Suppositories—for constipation, acting as mechanical irritant; 1 applied night and morning.

Spiritus Glycerylis Nitratis. Spirit of Glyceryl Trinitrate, *U.S.P.*—(Syn., Sp. Glyceryl. Nitrat., Spirit of Nitroglycerin, Spirit of Glonoin; Br. Liquor Trinitrini, Solution of Trinitrin; Propenyl Trinitrate.)

Manufacture: Gradually add dehydrated glycerin (7) to well-cooled solution of sodium nitrate (20) in sulphuric acid (40); or slowly add glycerin (1) to a mixture of nitric acid 1 and sulphuric acid 2 (7), at below 27° C. (80° F.), the radical NO_3 replacing hydroxyl in the glycerin—$C_3H_5(OH)_3 + 3HNO_3 = C_3H_5(NO_3)_3 + 3H_2O$; in either case the glyceryl trinitrate separates as an oily layer, which is washed with water and dilute sodium hydroxide solution to remove acid. It is an alcoholic solution containing 1–1.1 p. c. of glyceryl trinitrate,

$C_3H_5(NO_3)_3$, clear, colorless, neutral, odor and taste of alcohol (must use caution in tasting, as a small quantity produces violent headache, as it does also when freely applied to the skin), sp. gr. 0.814–0.820. *Tests:* 1. Heat on water-bath 10 cc. with 1 cc. of potassium hydroxide T. S. until alcohol evaporated, heat portion of residue with 1.5 Gm. of potassium bisulphate—pungent odor of acrolein; dissolve remaining portion in 2 cc. of acidulated (H_2SO_4) distilled water, + few drops of diphenylamine T. S., pour solution upon 2 cc. of sulphuric acid in test-tube, so as to form a separate layer—dark blue color at zone of contact. 2. Mix 10 cc. with 11 cc. of distilled water—clear solution; add distilled water 2 cc.—turbid mixture. Should be kept cool, dark, remote from fire in well-stoppered bottles, and must be dispensed, handled, packed, transported, and stored with great care, as dangerous explosions may result when spilled and alcohol evaporated—should such occur pour over it at once a solution of potassium or sodium hydroxide to effect decomposition. Dose, ♏j–3 (.06–.2 cc.), mouth or hypodermically.

Preparation.—1. *Elixir Euphorbiæ Compositum*, *N.F.*, .875 p. c. *Unoff. Preps.: Liquor Trinitrini* (Br.), 1 p. c., + alcohol q. s. 100, dose, ♏ss–3 (.03–.2 cc.). *Tabellæ Trinitrini* (Br.), each contains trinitroglycerin, $\frac{1}{130}$ gr. (.0005 Gm.), dose, 1–2 tablets.

Properties and Uses.—Like amyl nitrite (or any nitrite), except that its action is not quite so prompt, but is more persistent. Relaxes arterial tension, allowing heart to beat more forcibly and regularly—cardiac depressant. Angina pectoris, asthma, interstitial nephritis, hemoptysis, convulsions, tetanus, collapse, illuminating-gas, strychnine and chloroform poisoning, cardiac stimulation. If taken early, often wards off attacks of cardiac pain and epileptic seizures. It is thought that in undergoing alkaline decomposition in the system the nitrite is formed, which yields nascent nitrous acid. In chronic poisoning have distracting throbbing headache, increased by reclining.

III. Aldehydes.

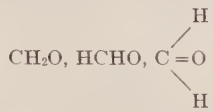
1. Halogen Derivatives.

Aldehydes are obtained from alcohol by removing 2 atoms of hydrogen, hence name *al*(cohol) + *dehyd*(rogenatus)—*de*, from, + hydrogen—*i. e.*, alcohol deprived of hydrogen. They are chemically between alcohols and acids, and may be considered hydrocarbon radicals attached to COH, thus:

(1) $C_2H_6 - H = C_2H_5$. Ethane. Hydrocarbon Radical. (2) $C_2H_5 + OH = C_2H_5OH$. Ethyl Alcohol. (3) $C_2H_6O - H_2 = C_2H_4O$. Ethyl Alcohol. Acetic Aldehyde.

The hydrogen may be removed by oxidation, when 1 atom of outside oxygen combines with 2 atoms of alcoholic hydrogen, forming 1 molecule of water and the aldehyde, which by further oxidation forms its corresponding acid.

Liquor Formaldehydi. Solution of Formaldehyde, *U.S.P.*—(Syn., Liq. Formaldehyd., Formalin, Formal, Formol; Fr. Soluté d'Aldehyde de formique; Ger. Formaldehyd solutus, Formaldehydlösung.)



CH_2O, HCHO, $H-C(=O)-H$

Manufacture: Pass heated vapors of methyl alcohol mixed with air over glowing coke or copper spirals, or pass methane (marsh gas) over a heated mixture of copper, pumice, and asbestos fibers, and the resulting products of oxidation into water, removing any undecomposed methyl alcohol by subsequent distillation, and adjusting proper strength by dilution or concentration. It is a clear, colorless or nearly colorless aqueous liquid (solution), pungent odor, vapor an irritant to mucous membrane of throat and nose, miscible with water or alcohol, sometimes cloudy on long standing, especially in the cold, from separation of paraformaldehyde; evaporate over sulphuric acid, or in vacuum, have formed rapidly solid paraformaldehyde; heat above 100° C. (212° F.) sublimes; at 153–172° C. (307–342° F.) melts, evolving gaseous formaldehyde; contains 37 p. c. by weight of formaldehyde, H.CHO, with varying amounts of ethyl or methyl alcohol, or both, to prevent polymerization. *Tests:* 1. Dilute 2 cc. with distilled water 10 cc., + 1 cc. of silver ammonium nitrate T. S.—metallic silver produced either as finely divided gray precipitate or bright metallic mirror on sides of test-tube. 2. Add 2 drops to 5 cc. of sulphuric acid containing .02 Gm. of salicylic acid, warm gently—permanent deep red color. *Impurities:* Free acids, etc. Should be kept dark, moderately warm.

Preparation.—1. *Formaldehydum Cresolatum, N.F.,* 60 p. c., liq. formaldehyd. 60 cc., orthocresol 40.

Unoff. Prep.: Liquor Formaldehydi Saponatus (Br.), 20 p. c., + soft soap 40, alcohol 30, aq. dest. q. s. 100.

Properties and Uses.—Antiseptic, disinfectant, germicide, irritant, preservative; about equal to corrosive mercuric chloride in power. A room containing 500 cubic feet can be disinfected by 1 pint (.5 L.) when converted into vapor, within an hour, or 2 pints (1 L.) will suffice for an ordinary-sized room. Has been employed largely but unlawfully for preserving milk, food, beer, wine, etc.; used also intravenously for combating septicemia; diluted with 2–10 parts water claimed to retard growth of uterine cancer.

Veroform Germicide and *Veroform Antiseptic* are solutions of soap containing formaldehyde gas, the former 20 p. c., the latter 6 p. c., useful in sterilizing hands, etc.

Paraformaldehydum. Paraformaldehyde, $(HCHO)_3$, *U.S.P.*—(Syn., Paraform, Trioxymethylene, Triformol; Fr. Paraldéhyde formique; Ger. Paraformaldehyd.)

Manufacture: This polymeric form of formaldehyde is obtained by evaporating formaldehyde solution (40 p. c. aqueous solution), when a portion of the gas volatilizes and another portion polymerizes and becomes insoluble, separating as white flocculent mass, which upon drying has the composition $(CH_2O)_3$. It is in white, friable masses, powder, slight odor of formaldehyde, on heating partly converted into formaldehyde and partly sublimed unchanged; slowly soluble in cold water, more readily in hot water with the formation of formaldehyde, insoluble in alcohol, ether, soluble in fixed alkali hydroxide solutions; contains 95 p. c. of $(HCHO)_3$. *Tests:* 1. Mix .01 Gm. with morphine sulphate .01 Gm. + 10 drops of sulphuric acid—violet-red color, changing to blue. 2. Gently warm .02 Gm. with 5 cc. sulphuric acid in which .1 Gm. salicylic acid has been dissolved—deep red; ash .1 p. c.; shake .5 Gm., finely powdered, with 10 cc. of distilled water—latter remains neutral. *Incompatibles:* Bases, oxidizing agents, gelatin, tannin, etc. Should be kept cool, dark, in well-closed containers.

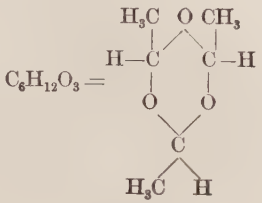
Properties and Uses.—Antiseptic (internally and externally), escharotic, disinfectant by heating (preferably compressed tablets); inhalations; warts, etc. Dose, gr. 5–15 (.3–1 Gm.); externally 10 p. c. suspension in collodion.

Methenamina. Methenamine, $(CH_2)_6N_4$, *U.S.P.*—(Syn., Methenam., Hexamethylenamina, Hexamethylenamine, Hexamethylenetetramine, Urotropinum, Urotropine, Uritone, Formin, Aminoform, Cystogen; Br. Hexamina, Hexamine; Ger. Hexamethylentetramin(um). A condensation product of ammonia and formaldehyde.)

Manufacture: Add stronger ammonia water (80), in successive portions, to a 40 p. c. solution of formaldehyde (100), keep well cooled, set aside 12–24 hours to crystallize. It is in colorless, lustrous, odorless crystals, white crystalline powder, soluble in water (1.5), alcohol (12.5), chloroform (10); aqueous solution alkaline; at 263° C. (506° F.) sublimes without melting, but with partial decomposition, emitting disagreeable odor, burns with a smokeless flame. *Tests:* 1. Heat aqueous solution (1 in 10) with diluted sulphuric acid—decomposes with liberation of formaldehyde (odor; and darkens paper moistened with silver ammonium nitrate T. S.). 2. Heat aqueous solution (1 in 10) with diluted sulphuric acid, supersaturate with sodium hydroxide solution—ammonia evolved; ash .05 p. c. *Impurities:* Heavy metals, ammonium salts, chloride, sulphate. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.).

Properties and Uses.—Antiseptic; it is absorbed rapidly, a value due to its partial change into and liberation as formaldehyde in the urine. The urine usually is rendered acid, but should it remain alkaline no decomposition takes place, nor is any antiseptic action secured; solvent for uric acid; similar to piperazine; pyelitis, cystitis, phosphaturia, gonorrhea, typhoid fever, renders urine clear and acid when loaded with pus, urates and phosphates.

Paraldehydum. Paraldehyde, *U.S.P.*—(Syn., Paraldehyd., Paracetaldehyde; Fr. Paraldéhyde, Elaldéhyde; Ger. Paraldehyd.) A polymer of acetaldehyde, C_2H_4O.

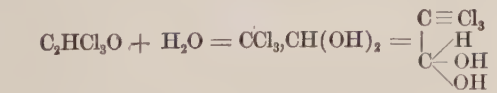


Manufacture: Paraldehyde (Gr. παρά, resembling, +) is obtained usually by passing hydrochloric acid gas into aldehyde, or by adding to ordinary (ethyl) aldehyde a small quantity of either SO_2, HCl, $ZnCl_2$, or sodium acetate; the temperature of the mixture rises, and almost a complete conversion into paraldehyde takes place. It is a colorless, transparent liquid, strong, characteristic, not unpleasant or pungent odor, disagreeable taste; soluble in water (8), boiling water (17), miscible with alcohol, chloroform, ether, volatile oils, neutral or slightly acid, sp. gr. 0.990, boils at 123° C. (253° F.), congeals at not below 9° C. (48.2° F.); when heated with a little sulphuric acid is converted into acetaldehyde, recognized by its odor. *Impurities:* Amyl alcohol, sulphate, chloride, free acid, acetaldehyde, substances from fusel oil. Should be kept cool, dark, in well-closed containers. Dose, ℥xv–60 (1–4 cc.), largely diluted with syrup and flavored with tincture of orange peel or some aromatic, the taste being disagreeable.

Properties.—Soporific, hypnotic, antiseptic; no influence over pain. Excessive doses weaken heart action. Kills by paralysis of the respiratory center, moderate doses cause 5–7 hours of refreshing, dreamless sleep, without unpleasant after-effects. May create *paraldehyde habit*, emaciation, etc.

Uses.—Same indications as chloral hydrate—insomnia from mental strain, insanity, mania, melancholia, delirium tremens, cardiac affections; allays itching in jaundice, vomiting in nauseating headache, pregnancy, and irritable ovary, excellent in strychnine poisoning, morphine habit, often produces erythematous rash.

Chloralis Hydras. Chloral Hydrate, *U.S.P.*—(Syn., Chloral Hydr., Chloralum Hydratum, Hydrated Chloral, U.S.P. 1910, Aldehydum Trichloratum, Hydrous Chloral, Trichloraldehyde Hydrate; Br. Chloral Hydras; Fr. Hydrate de Chloral; Ger. Chloralum hydratum, Chloralhydrat.) A compound of trichloraldehyde or chloral with the elements of 1 molecule of water.



Manufacture: Chloral (*chlor*(ine) + *al*(cohol)) is acetic aldehyde, C_2H_4O, in which 3 hydrogen atoms have been replaced by 3 chlorine atoms, and is made, as the name would suggest, by passing dry chlorine gas into anhydrous alcohol until saturated, which requires from a few hours to many weeks, according to amount of alcohol operated upon; when hydrochloric acid gas ceases to distil the temperature is increased gradually to 70° C. (158° F.), and the saturated liquid, which congeals on cooling, is shaken with sulphuric acid to decompose chloral alcoholate, remove alcohol and other impurities; the colorless oily layer that separates is removed and rectified direct over lime and calcium carbonate; this rectified distillate (anhydrous chloral) is mixed with water (82 parts chloral + 10 water), mixture poured upon plates under bell-glass, and allowed to crystallize—chloral hydrate—$C_2H_6O + 2Cl = C_2H_4O + 2HCl$; $C_2H_4O + 6Cl = C_2HCl_3O + 3HCl$. It is in colorless, transparent crystals, aromatic, penetrating, slightly acrid odor, bitterish, caustic taste, slowly volatilizes in air, soluble in water (.25), alcohol (1.3), chloroform (2), ether (1.5), olive oil, oil of turpentine; liquefies when treated with an equal quantity of camphor, menthol, phenol, or thymol; decomposed by caustic alkalies, alkaline earths, ammonia—chloroform, + a formate of the base being produced; contains 99.5 p. c. of chloral hydrate. *Tests:* 1. Warm with a few drops of aniline and sodium hydroxide T. S.—intensely disagreeable odor of phenylisocyanide. 2. Incinerate—ash .05 p. c.; does not readily attract moisture; gently ignite 2 Gm.—no inflammable vapors (dif. from chloral alcoholate). *Impurities:* Chloride, chloral alcoholate, readily carbonizable substances. Should be kept cool, dark, in tightly-stoppered bottles. Dose, gr. 5–20 (.3–1.3 Gm.), not safe to exceed this owing to possible cumulative tendency, etc.; 10 gr. (.6 Gm.) have occasioned death.

Preparations.—1. *Chloral Camphoratum, N.F.*, 50 p. c. + camphor 50. 2. *Mistura Chloralis et Potassii Bromidi Composita, N.F.*, 20 p. c., + potassium bromide 20, ext. of cannabis .2, ext. of hyoscyamus .2, pumice 2, water q. s. 100. Dose, ʒss–2 (2–8 cc.).

Unoff. Prep.: Syrupus Chloral (Br.), 20 p. c., dose, ʒss–2 (2–8 cc.).

Properties.—Externally—antiseptic, vesicant, irritant, anodyne. Internally—soporific, hypnotic, gastric irritant, general depressant (vasomotor center, also heart becomes slow, feeble, irregular, stopping in diastole), usually contracts pupils, produces sleep quickly, is certain, and has no unpleasant after-effects, circulates in the blood unchanged, may be decomposed finally if urine is alkaline.

Uses.—Externally—mixed with camphor, menthol, etc., anodyne in neuralgia, caries of teeth, for toothache, foul sores, ulcers, fetor of feet, chapped nipples, erectile tumor, gonorrhea, diphtheria, night-sweats. Internally—nervous insomnia from overwork, worry, etc., acute fevers, acute congestion of brain, cerebral inflammation, mania, delirium tremens, tetanus, hysteria, chorea, epilepsy, local spasms, asthma, strangulated hernia, spasm of the glottis, spasmodic croup, hiccough,

incontinence of urine, insanity, to relieve pain, nervous headache, angina pectoris, convulsions, whooping-cough, dysentery, typhoid fever, strychnine, hyoscine, and physostigmine poisoning.

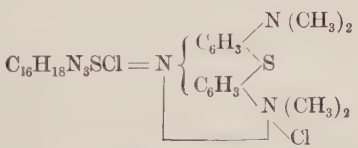
Poisoning: Resembles opium somewhat; have deep coma, weak, irregular, slow pulse, pupils dilated when awake, slow respiration, lividity, reflexes abolished, skin cold, temperature below normal. Give emetics or wash out stomach, weak potassium hydroxide solution, cold to head and neck; abundant fresh air, cataplasms, hot bottles, blankets, massage and friction to increase heat; keep awake with coffee, caffeine, galvanism, flagellation, hypodermic strychnine or picrotoxin, Hoffman's anodyne, or inhale amyl nitrite as respiratory and circulatory stimulant, artificial heat and respiration.

Chloral habit (*toxemia, chloralism*) is soon acquired, and is manifested in voluble speech, injected eyes, gastro-intestinal irritation, erythematous eruptions, dyspnea, general weakness, and permanent mental disturbance. To cure, should withdraw drug, use hygienic and medicinal tonics with cannabis.

Incompatibles: Alkalies, lime water, atropine, strychnine, external heat.

Synergists: Hypnotics, morphine (also lessens heart depression).

Methylthioninæ Chloridum. Methylthionine Chloride, *U.S.P.*—(Syn., Methylthionin. Chlor., Methylene Blue, Methylthioninæ Hydrochloridum, U.S.P. 1900, Tetramethylthionine Hydrochloride; Fr. Chlorhydrate de Tetraméthylethionine; Ger. Methylenum cæruleum, Methylenblau, Tetramethylthioninchlorid.)

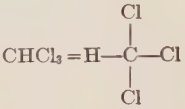


Manufacture: This tetramethylthionine chloride, $C_{16}H_{18}N_3SCl + 3H_2O$, is obtained by treating para-amido-dimethylaniline in hydrochloric acid solution with hydrogen sulphide, and subsequently with ferric chloride; or act upon para-amido-dimethylaniline hydrochloride with sodium nitrite, hydrogen sulphide and ferric chloride. It is a dark green, crystalline powder or crystals with bronze-like luster, odorless, stable in air, freely soluble in water, alcohol, chloroform, the solutions being deep blue. *Tests:* 1. Aqueous solution with hydrochloric acid changes to lighter blue; with sodium hydroxide T. S. changes to purplish, and if in excess produces, on standing, a dull violet precipitate. 2. Solution in diluted sulphuric acid, + zinc dust—decolorizes gradually; ash 1 p. c. *Impurities:* Arsenic, zinc, dextrin, moisture. Dose, gr. 1–5 (.06–.3 Gm.).

Properties and Uses.—Should not be confounded with methyl blue; anodyne, antiperiodic, antipyretic, analgesic, antiseptic; rheu-

matism, neuralgia, cystitis, intermittent fevers (good substitute for quinine), urethritis, colors urine blue, and may irritate neck of bladder.

Chloroformum. Chloroform, *U.S.P.*—(Syn., Chlorof., Chloroformum Purificatum, Formylum Trichloratum, Terchloride of Formyl, Dichlormethyl Chloride; Fr. Chloroforme (pur); Ger. Chloroformium, Chloroform.) A liquid consisting of 99–99.5 p. c. by weight of absolute chloroform and .5–1 p. c. of alcohol.



Manufacture: Chloroform (*chlor*(ine) + *form*(yl) is the trichloride of methane, CH_4, in which 3 hydrogen atoms are removed and replaced by 3 chlorine atoms. In actual practice, water 24 parts, alcohol 1, chlorinated lime 6, are put into a still and heated to 50° C. (122° F.), when chloroform, alcohol and water distil over, the heat from chemical reaction being sufficient to continue the process; the distillate consists of two layers, and the lower is removed, thoroughly washed with water (to get rid of undecomposed alcohol), then repeatedly with sulphuric acid until it is no longer discolored; now treat with sodium carbonate solution, wash with water, dehydrate with dried calcium chloride, potassium carbonate or phosphoric anhydride, and fractionally distil, collecting that coming over at 59–62° C. (138–144° F.). Here the chlorine of the lime converts alcohol into aldehyde, then into chloral, which is decomposed at once by the inherently formed alkali—calcium hydroxide—into chloroform and calcium formate, $Ca(CHO_2)_2$, hence the various names—$2C_2H_6O + Ca(OCl)_2 = 2C_2H_4O + CaCl_2 + 2H_2O$; $2C_2H_4O + 3Ca(OCl)_2 = 2C_2HCl_3O + 3Ca(OH)_2$; $2C_2HCl_3O$ (chloral) + $Ca(OH)_2 = 2CHCl_3 + Ca(CHO_2)_2$. This process has now given way to that of acetone, which consists in distilling acetone (10) diluted with water (30) + chlorinated lime (100) with water (300); purify as above—$2C_3H_6O + 3Ca(OCl)_2 = 2C_3H_3OCl_3 + 3Ca(OH)_2$; $2(C_3H_3OCl_3) + Ca(OH)_2 = 2CHCl_3 + Ca(C_2H_3O_2)_2$. It is a clear, colorless, mobile liquid, characteristic, ethereal odor, burning, sweet taste, soluble in water (210), miscible with alcohol, ether, benzene, petroleum benzin, fixed or volatile oils, boils at 61° C. (142° F.), sp. gr. 1.476, non-inflammable, but its heated vapor burns with a green flame. *Test:* 1. Pour 20 cc. upon odorless filter paper on a warmed glass plate, rock plate from side to side until liquid evaporated—no foreign odor preceptible as last portions disappear, paper odorless. *Impurities:* Chloride, free chlorine, substances decomposable by sulphuric acid (dark), chlorinated decomposition products. Should be kept cool, dark, in well-stoppered bottles, protected from contact with cork stoppers by covering them with tin foil, or other suitable material; care should be used in vaporizing it in the presence of naked flame, as noxious gases are produced.

Purification: When chloroform contains any of the preceding, it should be purified by taking 400 Gm. and shaking with H_2SO_4 80 Gm. occasionally for 24 hours, avoiding exposure to bright daylight; this process chars and removes hydrocarbons; now separate lighter chloroform layer and shake it with dried Na_2CO_3 20 Gm. to free from acid, transfer chloroform to dry retort, add deodorized alcohol 4 cc., and distil at 67° C. (153° F.) until the distillate measures 255 cc. Dose, ℿij–20 (.13–1.3 cc.).

Preparations.—1. *Aqua Chloroformi.* Chloroform Water, *U.S.P.* (Syn., Aq. Chlorof.; Fr. Eau de Chloroforme; Ger. Chloroformwasser.)

Manufacture: To a convenient quantity of distilled water (750 cc.), in a dark amber-colored bottle, add enough chloroform (4 cc.) to maintain slight excess of latter after repeated and thorough shaking; when required for use pour off needed quantity, refill bottle with distilled water, saturate by thorough agitation, always preserving an excess of chloroform. Should be kept in well-stoppered, amber-colored bottles. Dose, ʒj–4 (4–15 cc.).

Preps.: 1. *Extractum Ergotæ Aquosum, N.F.,* q. s. 2. *Fluidglycerata, N.F.,* q. s.

2. *Linimentum Chloroformi.* Chloroform Liniment, *U.S.P.* (Syn., Lin. Chlorof.; Fr. Liniment au Chloroforme; Ger. Chloroformliniment.)

Manufacture: 30 p. c. Mix by agitation chloroform 30 cc., soap liniment 70 cc.; used externally.

3. *Spiritus Chloroformi.* Spirit of Chloroform, *U.S.P.* (Syn., Sp. Chlorof., Chloric Ether, Spirit of Chloric Ether; Fr. Alcoolat (Alcoolé) de Chloroforme; Ger. Chloroformspiritus.)

Manufacture: 6 p. c. Mix chloroform 6 cc. with alcohol q. s. 100 cc. Dose, ʒss–1 (2–4 cc.).

4. *Linimentum Aconiti et Chloroformi, N.F.,* 12.5 p. c. 5. *Mistura Chloroformi et Morphinæ Composita, N.F.,* 12.5 p. c. 6. *Mistura Opii et Chloroformi Composita, N.F.,* 8 p. c. 7. *Petroxolinum Chloroformi Camphoratum, N.F.,* 20 p. c. 8. *Solutio Mastiches Chloroformica Composita, N.F.,* dissolve mastic 30 Gm. + balsam of Peru 30 cc. in chloroform q. s. 100 cc. (Pulp Capping Varnish). 9. *Solutio Resinæ Chloroformica, N.F.,* dissolve rosin 20 Gm. in chloroform 100 cc. 10. *Dentilinimentum Aconiti Compositum, N.F.,* 13.5 p. c. 11. *Dentilinimentum Aconiti et Iodi Compositum, N.F.,* 16.5 p. c. 12. *Elixir Ammonii Valeratis, N.F.,* .15 p. c. 13. *Elixir Phosphori, N.F.,* $\frac{1}{2}$ p. c. (phosphorus $\frac{1}{40}$ p. c.). 14. *Elixir Phosphori et Nucis Vomicæ, N.F.,* $\frac{1}{3}$ p. c. (phosphorus $\frac{1}{60}$ p. c.). 15. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.,* .22 p. c. 16. *Liquor Pancreatini, N.F.,* $\frac{1}{5}$ p. c. 17. *Syrupus Pini Albæ Compositus,* $\frac{3}{5}$ p. c.

Unoff. Preps.: Emulsum Chloroformi—chloroform 4 cc., expressed oil of almond 6 cc., tragacanth 1 Gm., water q. s. 100 cc., dose, ʒj–4 (4–15 cc.). *Tinctura Chloroformi et Morphinæ Composita* (Br.), chloroform 7.5 p. c., morphine hydrochloride 1, diluted hydrocyanic acid .5,

tincture of capsicum .25, tincture of Indian hemp 10, dose, ♏v–15 (.3–1 cc.).

Properties.—Internally—irritant, anesthetic locally, astringent, stimulant, narcotic. Inhalation—*first stage* is that of general stimulation, excited imagination, feeling of warmth and comfort, mind incoherent, confused, pupils dilated, may laugh, kick, fight, vomit, or cry unconsciously, pulse increases, heart and great vessels throb, may have choking, cessation of breathing, flushed face; the *second stage* is that of depression, complete unconsciousness, sees, hears, and feels nothing; *third stage* is that of total abolition of reflex excitability, may pass urine and feces involuntarily. Externally—irritant, vesicant, anesthetic. Should not be given to those having lung affections, fatty or feeble hearts, nor to the very old, while an overdose internally will produce death as by inhalation.

Uses.—Internally or inhalation—toothache, dyspepsia, setting fractured bones, dislocations, strangulated hernias, hiccough, chorea, hysteria, whooping-cough, asthma, angina pectoris, biliary and nephritic colic, tetanus, hydrophobia, tic douloureux, vomiting of pregnancy, labor, painter's colic, dysmenorrhea, spasms of bladder or rectum, gastric ulcer, colic, pain from calculi, convulsions, fevers. Externally—toothache, headache, rheumatism, neuralgia, dysmenorrhea, painful parturition, swelled testicle, hemorrhoids, hemorrhage, tenia.

When inhaled, should be with abundance (95 p. c.) of air. It requires usually 2–3 minutes to produce insensibility (much more quickly than with ether), which lasts only 5–10 minutes, unless inhalation is continued or morphine injected, which latter prolongs the effect considerably. One fluidrachm (250 drops; 4 cc.) will suffice for each inhalation, though more at the initial stage often is required.

Poisoning: Have irregular, shallow, stertorous breathing, dilated pupils. If swallowed, empty the stomach by pump, siphon, or emetics, give enema of hot coffee, large draughts of water containing sodium bicarbonate, demulcents, and treat as if inhaled, thus: Lower the head, pull forward the tongue to admit air, artificial respiration for an hour, electricity, hot and cold douche, inhale amyl nitrite, ether, ammonia, friction, heat, give brandy, atropine, strychnine. One death occurs in every 3000 inhalations. On recovery, first the muscles regain power of involuntary motion, sensibility next is regained, and lastly consciousness, which may require hours for perfect restoration. There is never remembrance of occurrences during the insensibility; even the nausea, vomiting, etc., are wholly involuntary.

Incompatibles: Weak alcoholic spirits, glycerin, stimulants, galvanism.

Synergists: Anesthetics, alcohol, chloral hydrate, morphine, etc.

Allied Products:

1. *Bromoformum. Bromoform*, $CHBr_3$, U.S.P. 1900–1910.—Obtained by making chlorinated lime (60) into a paste with water and adding

it to potassium bromide (71.5) dissolved in water (150), adding acetone (12), distilling in a current of steam until oily drops cease to come over, cooling apparatus, adding chlorinated lime (60), acetone (9), distilling; repeat this operation three times with similar parts of chlorinated lime and acetone, wash distillates, shake with sulphuric acid, again wash with water, and solution sodium hydroxide, dehydrate with fused calcium chloride, distil at 150° C. (302° F.), reserving the distillate; or add bromine gradually to solution of potassium hydroxide in alcohol as long as the color is discharged; or act on acetone with potassium (calcium) hypobromite, distil—$C_3H_6O + 3KBrO = C_3H_3Br_3O + 3KOH$; $C_3H_3Br_3O + KOH = CHBr_3 + KC_2H_3O_2$. It is a heavy, transparent, colorless, mobile liquid, ethereal odor, penetrating, sweet taste, resembling chloroform, slightly soluble in water; miscible with alcohol, chloroform, ether, benzene, petroleum benzin, fixed or volatile oils, sp. gr. 2.610, slightly volatile, non-inflammable, vapors may be ignited; contains 96 p. c., by weight, of bromoform and 4 p. c. of dehydrated alcohol; a fluidram represents 360 drops. Evaporate 10 cc. from porcelain dish on water-bath—residue .006 Gm. Anesthetic by inhalation, but has caused alarming symptoms, sufficient to prevent its employment; like chloroform depresses reflex centers of spine, decreasing their functions; produces sleep, insensibility to pain by depressing action upon cerebral centers; depresses vasomotor center, lessening blood-pressure thus dissipates heat; pulse remains full and strong, as heart and peripheral vagi are seemingly not affected. Chiefly employed internally as a palliative in whooping-cough, decreasing the number and intensity of paroxysms, but does not shorten the disease, also given for hiccough, spasmodic asthma, laryngismus stridulus, cough of phthisis, chronic bronchitis, reflex headache, vertigo. *Poisoning:* Laughing intoxication, nausea, vomiting, cyanosis, loss of reflex action, coma, collapse, cardiac failure, extreme pallor, fatty degeneration of the viscera. Use external heat, hypodermic ether and strychnine, electricity, which generally return consciousness in 4–6 hours. *Impurities:* Acetone, bromides, brominated compounds, free bromine, free acid. Should be kept cool, dark, in glass-stoppered bottles. Dose, ♏ij–5 (.13–.3 cc.), on sugar, in capsules, in alcohol, glycerin, or compound tincture of cardamom.

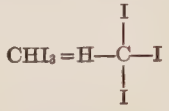
2. *Chloretone. Chlorbutanol, Acetone-chloroform. Trichlorbutyl Alcohol,* $C_4H_7OCl_3$.—Obtained by the interaction of chloroform, acetone, and an alkali, and occurs in white crystals, soluble in alcohol, largely in warm water, sparingly in cold, sublimes at body temperature into white glistening needles, stable in presence of diluted acids and alkalies; permanent, non-toxic, non-irritating.

Properties and Uses.—Hypnotic, analgesic, local anesthetic, anodyne, sedative, antiseptic; resembles cocaine, but has less toxic effects upon the heart; slightly lessens pulse-rate, but does not reduce force of cardiac systole nor lower the blood-pressure; considered superior to cocaine, beta-eucaine, chloral hydrate, sulphonal, trional,

etc., for insomnia, gastric carcinoma, gastritis, sea-sickness, vomiting of pregnancy, nausea, wounds, cuts, abrasions, minor operations. Dose, gr. 5–15 (.3–1 Gm.); apply locally the powder or saturated aqueous solution.

Chloroform made by the acetone process has been sold under this name, with the recommendation of its not reducing the force of cardiac systole nor lowering blood-pressure.

Iodoformum. Iodoform, *U.S.P.*—(Syn., Iodof., Diiodomethyl-iodide, Carboneum Jodatum, Ioduretum Carbonici, Triiodomethane; Fr. Iodure de Formyle, Iodoforme; Ger. Jodoformium, Jodoform.)



Manufacture: Iodoform (*iod*(ine) + (chlor)*oform*) is the triiodide of methane (triiodomethane), CH_4, where 3 hydrogen atoms are removed and replaced by 3 iodine atoms, similar to chlorine in chloroform; obtained practically by the action of iodine upon alcohol (acetone), in the presence of an alkali or alkali carbonate: heat together in a closed vessel iodine, alcohol (acetone), potassium bicarbonate (carbonate, hydroxide)—$C_2H_5OH + 4I_2 + 2KHCO_3 = 2CHI_3 + 2KI + 3H_2O + 2CO_2$. It is a fine, lemon-yellow powder, lustrous crystals; peculiar, very penetrating, persistent odor; (unpleasant, slightly sweetish taste, suggestive of iodine); nearly insoluble in water to which, however, it imparts its odor and taste, soluble in alcohol (60), boiling alcohol (16), glycerin (80), chloroform (10), ether (7.5), carbon disulphide (2.8), olive oil (34); solutions neutral; contains 96.69 p. c. of iodine. *Tests:* 1. Slightly volatile at ordinary temperatures, in boiling water distils slowly with the steam; melts at 115° C. (239° F.) to a brown liquid, decomposes at higher temperature, emitting vapors of iodine. 2. Incinerate 1 Gm.—ash .2 p. c.; dry 1 Gm. over sulphuric acid for 24 hours—loss only 1 p. c. *Impurities:* Acids, alkalies, soluble yellow coloring matter. Should be kept cool, dark, in well-closed containers. Dose, gr. 1–3 (.06–.2 Gm.), in pill; externally, as ointment, in collodion, alcohol, liniments, suppositories, gauzes, etc., or in dry powder.

Preparations.—1. *Unguentum Iodoformi.* Iodoform Ointment. (Syn., Ung. Iodof.; Fr. Pommade d'Iodoforme; Ger. Jodoformsalbe.) *Manufacture:* 10 p. c. Triturate iodoform 10 Gm. with previously melted petrolatum 70, incorporate wool fat 20; mix thoroughly. 2. *Glycerogelatinum Iodoformi, N.F.,* 10 p. c., iodoform 10 Gm., gelat. glycerin. 10, glycerin 15, aq. dest. 65 cc.

Unoff. Prep.: Suppositoria Iodoformi (Br.), each, 3 gr. (.2 Gm.).

Properties.—Internally—increases appetite, narcotic, eliminated by secretions, chiefly in urine, as iodine, iodides, and iodates. Externally—antiseptic, disinfectant, analgesic, local stimulant, anesthetic.

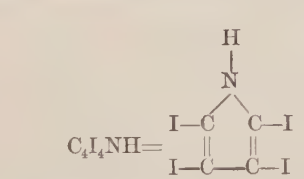
Uses.—Externally– ulcers, sores, wounds, tuberculous and syphilitic ulcers, cancer, metritis, endometritis, swollen glands, pleural effusions, also of pericardium, inflamed joints, diphtheria, chronic cystitis, goiter, gonorrhea, buboes, ozena, ulcer of tongue, chronic otorrhea, ringworm of scalp, purulent ophthalmia, ulcerated eyelids, corneal ulcers, hemorrhoids, lupus, pruritus of vagina and testes, skin diseases (eczema, psoriasis, prurigo), erysipelas, ulcers of larynx, nasal catarrh, gangrene, vaginismus, neuralgia, heart disease, orchitis, carious teeth, boils, carbuncles, scrofula. The odor may be modified by the addition of some aromatic substance, such as vanillin, musk, oils of bergamot, lavender, peppermint, sassafras, etc., balsam of Peru, thymol, eucalyptol, etc.

Poisoning: Usually have symptoms of meningitis—headache, stupor, gastro-intestinal irritation, melancholia, hallucinations, contracted pupils, high temperature, erythema, delirium, rapid pulse, death. Give potassium bromide, which dissolves the iodine compound, lemonade, potassium acetate solutions, stimulants, diaphoretics, diuretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

Incompatibles: Mercuric chloride, etc.

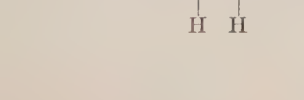
Related Product:

1. *Iodolum. Iodol* (Tetraiodo-pyrrol, Pyrrol Tetraiodide), C_4I_4NH, U.S.P. 1900.



Obtained from pyrrol, which in turn comes from Dippel's oil (bone oil), by purifying and acting upon it with iodine in alcoholic solution for 24 hours, then adding water to separate the iodol. It is a light grayish-brown crystalline powder, odorless, tasteless, soluble in fixed oils, sulphuric acid, alcohol (9), ether (1.5), chloroform (105), water (4900), decomposes at 145° C. (293° F.), liberating violet iodine vapors; contains iodine 88.97 p. c. *Impurities:* Inorganic substances, hydriodic acid, iodides, free iodine. Antiseptic, stimulant, a substitute for iodoform externally and for potassium iodide internally; tertiary syphilis, scrofula, diabetes, eczema, wounds. Dose, gr. $\frac{1}{2}$–10 (.03–.6 Gm.).

Æthylis Chloridum. Ethyl Chloride, *U.S.P.*—(Syn., Æthyl. Chlor., Æthylum Chloratum, Æther Chloratus, Monochlorethane, Hydrochloric Ether; Fr. Chlorure d'Éthyle, Ether hydrochlorique; Ger. Äthylchlorid, Chlorwasserstoffäther.)



Manufacture: Pass dry hydrochloric acid gas into alcohol, distil at moderate heat, wash distillate with water and weak alkaline solution, rectify; or heat equal volumes of alcohol and hydrochloric acid for a time under increased pressure (40 atmospheres) at 150° C. (302° F.), distil resulting product, pass vapors through warm water, then over calcium chloride (to dry), and condense in well-cooled vessels $C_2H_5OH + HCl = C_2H_5Cl + H_2O$. It is at low temperatures, or under pressure, a colorless, mobile, very volatile liquid, characteristic, ethereal odor, burning taste; soluble in alcohol, ether, slightly in water; sp. gr. 0.921; boils at 12.5° C. (54.5° F.); burns with smoky, greenish flame producing hydrogen chloride. *Tests:* 1. Dissolve .5 cc. in alcohol (10), both at melting ice temperature, + few drops of silver nitrate T. S.—no turbidity at once (abs. of chloride). 2. Shake 10 cc. with equal volume of distilled water, both at melting ice temperature, allow supernatant ethyl chloride to evaporate, add to residual neutral liquid a few drops of potassium dichromate T. S. + 2 cc. diluted sulphuric acid, boil—no odor of aldehyde, nor greenish or purplish liquid (abs. of alcohol). 3. Evaporate 5 cc.—no foreign odor at the last traces, and negligible residue. *Impurities:* Chloride, alcohol, etc. When liberated, at ordinary room temperature, from its sealed container it vaporizes at once, the gas being very inflammable and therefore must not be used in proximity to fire. On the market in small glass tubes, the pointed apex of which is broken off and the ethyl chloride vaporized by heat of the hand. Should be kept cool, dark, remote from fire in hermetically sealed containers. Dose, ℥x–30 (.6–2 cc.).

Properties and Uses.—Local and general anesthetic; in the former it freezes the part, producing white spot, and not until then is the incision made; in the latter (inhaled) action fleeting, not profound, hence unsuited for prolonged operations; used to benumb nerves in supraorbital neuralgia; in minor surgical operations, dentistry, etc.

Acetonum. Acetone, *U.S.P.*—(Syn., Aceton., Dimethyl-ketone, Acetylmethylid, Spiritus Pyroaceticus, Pyroacetic Spirit; Fr. Esprit pyroacétique; Ger. Azeton, Essiggeist, Mesitalkohol.)

$$(CH_3)_2CO{=}C(CH_3){=}O$$

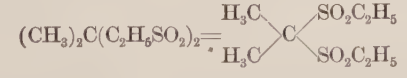
Manufacture: By the dry distillation of wood, of acetates, citric acid, sugar (carbohydrates) + lime, but chiefly from calcium acetate—$Ca(C_2H_3O_2)_2$ + dry distillation = $(CH_3)_2CO + CaCO_3$; the distillate is neutralized with dry sodium carbonate, treated with calcium chloride and purified by fractional distillation over lime; now made largely by decomposing acetic acid vapor by passing it through a rotating iron cylinder containing pumice stone and precipitated barium carbonate,

at a temperature of 500–600° C. (932–1112° F.)—$2HC_2H_3O_2$ + heat = $C_3H_6O + CO_2 + H_2O$. It is a transparent, colorless, mobile, volatile, neutral liquid, characteristic ethereal odor, pungent; miscible without cloudiness with water, alcohol, ether, chloroform, and most volatile oils; sp. gr. 0.790; boils at 57° C. (135° F.); inflammable—luminous non-sooty flame; contains 99 p. c. by weight of acetone. *Tests:* 1. Aqueous solution (1 in 200) 1 cc. + 1 cc. sodium hydroxide T. S., warm, add a few cc. iodine T. S.—yellow precipitate (iodoform) at once. 2. 1 cc. of same dilution + sodium nitroprusside T. S. + 2 cc. sodium hydroxide T. S., add slight excess acetic acid—deep red liquid, dilute with several volumes of water—violet tint. 3. Evaporate 50 cc.—residue .002 Gm. 4. Mix 20 cc. with $\frac{N}{10}$ potassium permanganate V. S.—pink tint should not disappear in less than 15 minutes (lim. of empyreumatic substances). *Impurities:* Empyreumatic substances, etc. Should be kept cool, remote from fire, in well-closed containers. Dose, ♏x–20 (.6–1.3 cc.).

Properties and Uses.—Anesthetic, soporific, anthelmintic; reduce temperature, cough, bronchial affections (diminish expectoration), rheumatism, gout, nausea, diarrhea, mostly as a solvent for resins, fats, oleoresins, camphor, gun-cotton, preparing chloroform—yielding of this 200 p. c. of its own weight when distilled with water and calcium hypochlorite.

2. Sulphur Derivatives.

Sulphonmethanum. Sulphonmethane, $C_7H_{16}S_2O_4$, *U.S.P.*—(Syn., Sulphonmeth., Sulphonal, Sulphonalum, Diethylsulphonedimethylmethane; Fr. Acetone-dimethylsulphone; Ger. Sulfonal.)



Manufacture: Pass dry hydrochloric acid gas into a mixture of anhydrous ethyl hydrosulphide, mercaptan, C_2H_5SH, (2) and anhydrous acetone (1), when the mixture gradually becomes hot and turbid, finally separating into two layers, the upper containing dithio-ethyl-dimethyl-methane (acetone mercaptol), $(CH_3)_2C(SC_2H_5)_2$, a condensation-product of the interaction between the mercaptan and acetone; this oily liquid is purified by washing, distilling, and shaking with 5 p. c. solution of potassium permanganate, thus oxidizing mercaptol into sulphonmethane. It is in colorless, odorless crystals, white powder, soluble in benzene, water (365), boiling water (16), alcohol (60), boiling alcohol (3), chloroform (11). *Tests:* 1. Melts at 125° C. (257° F.), at higher temperature—decomposes evolving sulphur dioxide. 2. Heat .1 Gm. with powdered charcoal .1 Gm.—characteristic unpleasant odor of mercaptan; incinerate 2 Gm.—ash .05 p. c. *Impurities:* Chloride, sulphate, readily oxidizable substances. Should be kept in well-closed containers. Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses.—Hypnotic, sedative. Resembles chloral hydrate, but is less apt to affect the heart; kills, however, by paralysis of respiration; it is given for the same conditions as chloral hydrate, but being so insoluble is absorbed slowly, hence is tardy in action; insomnia, delirium, typhoid fever, diabetes. Give an hour before bedtime in wine, beer, elixir, soup, milk, hot water, tablet or capsule.

Sulphonethylmethanum. Sulphonethylmethane, $C_8H_{18}S_2O_4$, *U.S.P.*—(Syn., Sulphonethylmeth., Trional, Trionalum, Diethylsulphonemethylethylmethane; Br. Methylsulphonal; Fr. Diéthylsulfone-méthyléthylméthane; Ger. Methylsulfonalum, Methylsulfonal.)

$$CH_3C_2H_5C(C_2H_5SO_2)_2 = \begin{matrix} H_3C \\ H_5C_2 \end{matrix} \!\!>\!\! C \!\!<\!\! \begin{matrix} SO_2C_2H_5 \\ SO_2C_2H_5 \end{matrix}$$

Manufacture: Pass dry hydrochloric acid gas into a mixture of ethyl mercaptan and methylethylketone until saturated, oxidize the resulting condensation-product, methylethylketonemercaptol, $(CH_3)(C_2H_5)C(SC_2H_5)_2$, with solution of potassium permanganate, purifying by frequent recrystallization from boiling water. It is in colorless, lustrous, odorless, crystalline scales, bitter taste in aqueous solution, soluble in alcohol, ether, water (200), more so in boiling water; saturated aqueous solution neutral; melts at 75° C. (167° F.). Responds to tests for identity and purity of sulphonmethane. Should be kept in well-closed containers. Dose, gr. 15–30 (1–2 Gm.).

Properties and Uses.—Hypnotic, sedative for the insane. Has prompt action without cumulative effect or tendency to create a habit; quicker and more certain than sulphonal, and largely used.

IV. Acids.

Acids are obtained from hydrocarbons by removing a hydrogen atom and substituting for it the univalent group carboxyl, CO_2H, or from alcohols by replacing 2 hydrogen atoms with 1 oxygen atom, thus:

CH_4	CH_3CO_2H	C_2H_6	$C_2H_5CO_2H$
Methane	Acetic Acid	Ethane	Propionic Acid

When this substitution is 1 hydrogen atom for 1 carboxyl group we have resulting monobasic acids; when 2 hydrogen atoms are replaced by 2 carboxyl groups we have dibasic acids, etc., thus:

$$CH_2\!\!<\!\!\begin{matrix} CO_2H \\ CO_2H \end{matrix}$$ =Malonic Acid.

$$C_2H_4\!\!<\!\!\begin{matrix} CO_2H \\ CO_2H \end{matrix}$$ =Succinic Acid, etc.

1. Monobasic Fatty Acids.

(These have 1 hydrogen atom replaceable by metals.)

Acidum Aceticum. Acetic Acid, $HC_2H_3O_2 = CH_3COOH$, *U.S.P.*—(Syn., Acid. Acet.; Fr. Acide acétique; Ger. Essigsäure.) An aqueous solution containing 36–37 p. c. of $HC_2H_3O_2$.

Manufacture: While this may be obtained by the oxidation of ethyl alcohol, most of it is the result of the dry distillation of wood, preferably white oak (*Quer'cus al'ba*), which is dry distilled at 205° C. (401° F.) for 7 days; gases, such as acetylene, C_2H_2, ethylene, C_2H_4, propene, C_3H_6, methane CH_4, carbon dioxide, CO_2, etc., escape; the wood, losing one-half in weight, becoming walnut-colored, but retaining original structure and elementary composition, remains in the retort, as does also a dark liquid, in two strata, at the bottom: the upper—aqueous, slightly colored, amounts to about 30 p. c. of the original weight of wood taken and is crude wood vinegar or pyroligneous acid, containing also methyl alcohol, acetone, guaiacol, pyrocatechin, furfurol, etc.; the lower—oily, is tarry and contains creosote, etc. The upper liquid is distilled, the first 10 p. c. going over being alcohol and acetone, while the next 75 80 p. c. is a yellow liquid, Acetum pyrolignosum rectificatum, P. G., with about 6 p. c. of acetic acid. This is now boiled with milk of lime, or neutralized with soda ash or sodium carbonate, giving calcium or sodium acetate in solution (if milk of lime used, should double decompose with sodium sulphate to get sodium acetate), filter solution, concentrate, crystallize, and distil this with H_2SO_4, when we get acetic acid of desired strength; thus, $NaC_2H_3O_2 + H_2SO_4 = HC_2H_3O_2 + NaHSO_4$. A more modern method, and one now usually employed, consists in securing from charcoal burners the acetic acid in the form of calcium acetate, dissolving and decomposing it with sodium sulphate, thus precipitating calcium sulphate and leaving sodium acetate in solution, which in turn is filtered and treated as the above similar solution. It is a clear, colorless liquid; strong, characteristic odor; sharply acid taste and reaction; miscible with water, alcohol, glycerin; sp. gr. 1.045. *Tests:* 1. Evaporate 20 cc. —residue .002. 2. Mix 5 cc. with 10 cc. ammonia T. S. + 5 cc. silver nitrate T. S., boil 1 minute—color not changed (abs. of formic or sulphurous acid). 3. Neutralized with ammonia water, + ferric chloride T. S.—deep red color, destroyed by mineral acids. *Impurities:* Heavy metals, chloride, formic, sulphuric, sulphurous acids, empyreumatic substances.

Preparations. —1. *Acidum Aceticum Dilutum.* Diluted Acetic Acid, *U.S.P.* (Syn., Acid. Acet. Dil.; Fr. Acide acétique dilué; Ger. Acetum Purum (Distillatum), Verdünnte Essigsäure.)

Manufacture: Mix acetic acid 16.5 Gm. with distilled water 83.5 Gm. It is an aqueous solution containing 5.7–6.3 p. c. of $HC_2H_3O_2$; miscible with water, alcohol; sp. gr. 1.008. *Tests* and *Impurities:* Same as for strong acid. Dose, ʒj–4 (4–15 cc.).

Preps.: 1. *Liquor Ammonii Acetatis*, 100 p. c. 2. *Mistura Adstringens, N.F.*, 74 p. c. 3. *Syrupus Allii, N.F.*, q. s.

2. *Extractum Nucis Vomicæ*, q. s.

3. *Acetum Aromaticum, N.F.*, 26 p. c. 4. *Linimentum Terebinthinæ Aceticum, N.F.*, 8 p. c. 5. *Liquor Alumini Subacetatis, N.F.*, 16 p. c.

Much of the weaker acetic acid is the result of weak alcohol or

aldehyde oxidation, made by allowing diluted alcohol (8–10 p. c.) to trickle downward through wood-shavings packed in barrels, so as to afford free circulation of air, the percolate being returned as often as (four times) required for complete oxidation. The presence of the growth "mother of vinegar" (*Mycoder'ma ace'ti*) facilitates greatly the conversion—$C_2H_5OH + O_2 = C_2H_3O,OH + H_2O$. This usually is called vinegar, and contains about 4–5 p. c. of pure acetic acid.

Acidum Aceticum Glaciale. Glacial Acetic Acid, $HC_2H_3O_2$, *U.S.P.*—(Syn., Acid. Acet. Glac.; Br. Acidum Aceticum (Concentratum), Acetum Glaciale; Fr. Acide acétique (concentré) Crystallizable, Esprit de Vinaigre, Acetum glacialé, Vinaigre Glacial; Ger. Essigsäure, Eisessig.)

Manufacture: Sodium acetate 13.5 parts, deprived of water of crystallization (then making 8.25 parts), is distilled with H_2SO_4 9.5–10 parts, when the distillate can be evaporated and crystallized at 0° C. (32° F.)—$NaC_2H_3O_2 + H_2SO_4 = HC_2H_3O_2 + NaHSO_4$. Every 136 parts of crystallized sodium acetate yields 60 parts of acetic acid. It is a clear, colorless liquid, strong, characteristic odor, pungent, acid taste and reaction, sp. gr. 1.048, congeals into crystals at 14.5° C. (58° F.), boils at 117° (243° F.), miscible with water, alcohol, glycerin; contains 99 p. c. of $HC_2H_3O_2$. *Tests* and *Impurities:* Same as for acetic acid, if diluted to its strength, but when 2 cc. are mixed with distilled water (10), + $\frac{N}{10}$ potassium permanganate V. S. (.1)—tint (pink) produced not changed to brown within 2 hours.

Preparations.—1. *Ceratum Cantharidis*, 2.5 p. c. (cantharides 35 p. c.). 2. *Tinctura Cantharidis*, 5 p. c. (cantharides 10 p. c.).

Properties.—Corrosive, irritant, refrigerant, astringent.

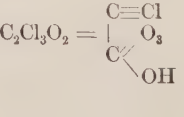
Uses.—Vapor applied to nostrils as an excitant in syncope, asphyxia, headache. Glacial Acid—mostly applied externally to warts, corns, for blistering, favus, lichen, prurigo, psoriasis, cancer, nasal polypus.

Allied Products:

1. *Acetum. Vinegar*, U.S.P. 1820–1870.—Obtained by the acetous fermentation of infusions of malted and unmalted grain, or of various fruit juices—apples (cider), etc.

2. *Acidum Aceticum Empyreumaticum. Pyroligneous Acid*, U.S.P. 1820–1830.—Obtained by the destructive distillation of wood; yield of acetic acid 6–8–9 p. c.

Acidum Trichloraceticum. Trichloracetic Acid, $HC_2Cl_3O_2$, *U.S.P.*—(Syn., Acid. Trichloracet., Chloracetic Acid; Fr. Acide trichloracetique; Ger. Trichloressigsäure.) A monobasic organic acid containing 99 p. c. of $HC_2Cl_3O_2$.



Manufacture: Add fuming nitric acid 63 Gm. to chloral hydrate 165.5 Gm., previously fused at 58° C. (136° F.), set aside mixture for an hour, or until red vapors cease to be formed, then carefully distil at 190° C. (374° F.). It is in colorless, deliquescent, crystals, slight, characteristic odor, acid reaction; soluble in water (.1), very soluble in alcohol, ether; heated with a solution of alkali hydroxide—decomposes into chloroform and alkali carbonate; ash .05 p. c. *Tests:* 1. Aqueous solution (1 in 20) 10 cc., + few drops of silver nitrate T. S.—only slightly opalescent (abs. of chlorides). 2. Dissolve in 5 cc. of aqueous solution (1 in 20) a small crystal of ferrous sulphate (.5 Gm.), superimpose it upon sulphuric acid, free from nitrogen compounds (5), so as to form a layer above—no brownish-red at zone of contact of two liquids (abs. of nitric acid).

Properties and Uses.—Antiseptic, escharotic. Penetrates deeply, but causes less pain than either silver nitrate, zinc chloride, or potassium hydroxide. Removes warts, condylomata, lupus, diseases of the nose and throat; used here in preference to chromic acid.

Acidum Acetyltannicum. Acetyltannic Acid, *U.S.P.*—(Syn., Acid. Acetyltan., Diacetyltannic Acid, Tannyl Acetate, Acetannin, Tannigen; Ger. Acetyltannin, Diacetyltannin.) A product obtained by the acetylization of tannic acid.

Manufacture: Heat tannic acid and acetic anhydride, in molecular proportions, in the presence of glacial acetic acid; when reaction complete pour product into water, wash precipitate with warm water, dry. It is a yellowish-white, grayish-white powder which darkens on exposure to light, odorless, slight acetous odor; soluble in ethyl acetate, aqueous solutions of sodium borate or phosphate, and with gradual decomposition in solution of alkali hydroxides and carbonates, slightly soluble in water or alcohol; loss in drying 3 p. c.; ash .3 p. c. *Tests:* 1. Warm .2 Gm. with 2 cc. alcohol + 2 cc. sulphuric acid—odor of ethyl acetate. 2. A solution in sodium phosphate T. S. (1 in 100) after standing several hours—precipitates albumin solution, a property destroyed in the presence of an excess of alkali; dissolved in aqueous solution of sodium borate (1 in 25)—does not precipitate albumin. *Impurities:* Free tannic acid, free acid, soluble substances. Should be kept dark, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.).

Properties and Uses.—Mild astringent; serous diarrhea, enteritis, dysentery, cholera infantum, intestinal tuberculosis.

Acidum Oleicum. Oleic Acid, $HC_{18}H_{33}O_2$, *U.S.P.*—(Syn., Acid. Oleic., Acidum (Oleinicum) Elainicum, Elaic Acid; Fr. Acide oléique; Ger. Oleinsäure, Oelsäure.) An acid obtained from fats, consisting chiefly of $HC_{18}H_{33}O_2$.

Manufacture: Digest almond oil with lead oxide and water, when dry separate oleate of lead from other salts by solution in ether, precipitate lead from ethereal solution with hydrochloric acid, evaporate filtrate;

large quantities are obtained also as a by-product in making stearic acid for stearin candles. It is a yellowish, brownish-yellow, oily liquid, peculiar, lard-like odor and taste, free from rancidity; darker and absorbs oxygen on exposure; almost insoluble in water, miscible with alcohol, chloroform, benzene, petroleum benzin, fixed or volatile oils, sp. gr. 0.895; congeals to solid, whitish mass at 4° C. (39° F.). *Tests:* 1. Incinerate 5 cc.—ash .005 Gm. 2. Shake with distilled water (1); the separated water after filtration + a drop of methyl orange T. S.—not reddened (abs. of mineral acids). 3. Boil 1 cc. + monohydrated sodium carbonate (.5) + distilled water (30) in a capacious flask—resulting solution, while hot, clear or possibly opalescent (abs. of neutral fat, mineral oils). *Impurities:* Mineral acids, neutral fat, mineral oils). Should be kept cool, in well-closed glass or stoneware containers.

PREPARATIONS.—1. *Oleatum Hydrargyri,* 75 p. c. 2. *Oleatum Quininæ, N.F.,* 75 Gm., + quinine 25. 3. *Oleatum Veratrinæ, N.F.,* 50 Gm., + veratrine 2, olive oil q. s. 100. 4. *Pasta Zinci Mollis, N.F.,* $2\frac{1}{2}$ p. c. 5. *Petrox. Guaiacolis, N.F.,* 5 p. c. 6. *Petrox. Hydrargyri, N.F.,* 2 p. c. 7. *Petrox. Liquidum, N.F.,* 30 p. c. 8. *Petrox. Spissum, N.F.,* 32 p. c. 9. *Petrox. Sulphuratum, N.F.,* 30 p. c. 10. *Unguentum Iodi Denigrescens, N.F.,* 20 p. c.

PROPERTIES AND USES.—Important, since it is a solvent for medicines to be applied by inunction and the base of official oleates, which do not decompose (becoming rancid, etc.) like ointments, and enter the skin deeper without irritation. Oleate of Mercury—good in skin diseases (sycosis, chloasma, pediculi), syphilitic affections, thinning and loss of hair; oleates of atropine, cocaine, quinine, veratrine, zinc, and some other unofficial oleates are very useful.

Acidum Stearicum. Stearic Acid, $HC_{18}H_{35}O_2$, *U.S.P.* (Syn., Acid. Stear., Acidum Stearinicum; Fr. Acide stéarique; Ger. Stearinsäure.) An acid obtained from tallow and other solid fats, consisting chiefly of $HC_{18}H_{35}O_2$.

Manufacture: This exists as the glyceride in all solid animal fats and in many oils, and is prepared from tallow by boiling with NaOH or K_2CO_3; this forms sodium stearate (soap) and liberates glycerin – $C_3H_5(C_{18}H_{35}O_2)_3 + 3NaOH = C_3H_5(OH)_3 + 3NaC_{18}H_{33}O_2$. The soap is decomposed by heating with water and H_2SO_4 (or HCl), thus setting free the fatty acids, which, floating on the surface, are removed; upon cooling, the solid acid mixture is subjected to strong pressure, thereby removing the fluid acids, oleic, etc. It is a hard, white, faintly yellowish, somewhat glossy and crystalline solid, odorless, slight tallow-like odor, tasteless, permanent, soluble in alcohol (21), chloroform (2), ether (3), freely in carbon disulphide, carbon tetrachloride, almost insoluble in water; melts at 56° C. (133° F.); congeals at 54° C. (129° F.); ash .1 p. c. *Tests:* 1. Boil 1 Gm. + monohydrated sodium carbonate .5 Gm. + distilled water 30 cc. in capacious flask—hot solution

not more than opalescent (abs. of neutral fat, paraffin). 2. Melt, shake with hot distilled water (1); separated water after filtration, + a drop of methyl orange T. S.—not reddened (abs. of mineral acids). *Impurities:* Neutral fat, paraffin, mineral acids.

PREPARATIONS.—1. *Suppositoria Glycerini*, each 4 gr. (.26 Gm.). 2. *Linimentum Saponato-Camphoratum, N.F.*, 5 p. c.

PROPERTIES AND USES.—Mainly in manufacturing glycerin suppositories, and as zinc and copper stearates, for various skin diseases.

2. DIBASIC FATTY ACIDS.

(These have 2 hydrogen atoms replaceable by metals.)

Acidum Tartaricum. Tartaric Acid, *U.S.P.*—(Syn., Acid. Tart., Sal Essentiali Tartari, Dioxysuccinic Acid; Fr. Acide du Tartre—tartrique; Ger. Acidum tartaricum, Weinsäure, Weinsteinsäure.) A dibasic organic acid, usually obtained from wine lees or argol, containing 99.5 p. c. of $H_2C_4H_4O_6$

$$H_2C_4H_4O_6 = \begin{matrix} C{<}\begin{matrix}H\\OH.\end{matrix} & COOH \\ | & \\ C{<}\begin{matrix}OH.\\H\end{matrix} & COOH \end{matrix} = C_2H_2{<}\begin{matrix}OH\\OH\\CO_2H\\CO_2H\end{matrix}$$

Manufacture: Tartaric acid is found in vegetables and fruits, free and combined with potassium or calcium. The grape contains most, having it in the form of potassium acid tartrate, crude tartar, or argol. This substance is soluble in an aqueous saccharine solution, as of fresh grape juice; but when the weak saccharine solution begins to ferment alcohol is formed, in which argol is not soluble, consequently it is precipitated. Although argol is principally potassium acid tartrate, it also contains some calcium, magnesium, iron and aluminum salts. It is dissolved in water at 140–170° C. (284–338° F.) under pressure, clear solution not quite neutralized with chalk, adding only until effervescence nearly ceases, in order to retain in solution the magnesium, iron and aluminum salts—$2KHC_4H_4O_6 + CaCO_3 = CaC_4H_4O_6 + K_2C_4H_4O_6 + CO_2 + H_2O$; calcium chloride is now added to the hot mixture to convert remaining soluble normal potassium tartrate into insoluble calcium tartrate—$K_2C_4H_4O_6 + CaCl_2 = CaC_4H_4O_6 + 2KCl$; the resulting calcium tartrate is washed and heated with diluted sulphuric acid at 75° C. (167° F.); the solution of free acid is evaporated in lead vacuum pans and allowed to crystallize in lead-lined vats—$CaC_4H_4O_6 + H_2SO_4 = H_2C_4H_4O_6 + CaSO_4$. It is in colorless, translucent, crystals, white granular or fine powder; odorless; acid taste and reaction; permanent; soluble in water (.75), boiling water (.5), alcohol (3), slightly in ether, almost insoluble

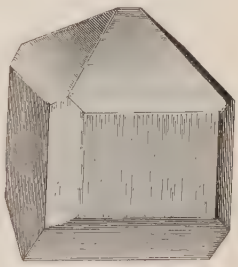


FIG. 470. — Tartaric acid crystal.

in chloroform. *Tests:* 1. Neutral solution + silver nitrate T. S.—white precipitate, upon dissolving in just enough ammonia T. S. and warming gives metallic mirror. 2. Ignited—gradually decomposes with odor of burning sugar (dif. from citric acid), ash .05 p. c. *Impurities:* Heavy metals, lead, sulphuric, oxalic acids. Dose, gr. 5–30 (.3–2 Gm.).

PREPARATIONS.—1. *Acidum Hydriodicum Dilutum* 12.2 p. c. 2. *Potassii Citras Effervescens*, 25.2 p. c. 3. *Pulvis Effervescens Compositus*, 19 p. c. (gr. 33.5). 4. *Sodii Phosphas Effervescens*, 25.2 p. c. 5. *Elixir Pepsini, Bismuthi et Strychninæ, N.F.*, .0175 p. c. 6. *Extractum Hydrastis, N.F.*, ½ p. c. 7. *Glyceritum Bismuthi, N.F.*, 23.8 p. c. 8. *Sal Carolinum Factitium Effervescens, N.F.*, 15.7 p. c. 9. *Sal Kissingense Factitium Effervescens, N.F.*, 9.4 p. c. 10. *Sal Lithii Citratis Effervescens, N.F.*, 30 p. c. 11. *Sal Magnesii Sulphatis Effervescens, N.F.*, 21.1 p. c. 12. *Sal Potassii Bromidi Effervescens Compositum, N.F.*, 18 p. c. 13. *Sal Vichyanum Factitium Effervescens, N.F.*, 16.45 p. c.

PROPERTIES AND USES.—Owing to its greater cheapness is much used in place of citric acid in making lemonade, effervescing drinks, powders, etc. When mixed with sugar, mucilage, aromatics, etc., it serves to moisten the throat in pharyngitis, pulmonary catarrh, to dissolve false membranes of diphtheria, correct fetor of feet, etc.

Related Acid:

1. *Acidum Oxalicum. Oxalic Acid*, $H_2C_2O_4,2H_2O$, U.S.P. 1870.—Obtained by oxidizing many organic substances (fats, sugars, starch, etc.) with nitric acid or other strong oxidizing agents; also on large scale by heating sawdust with KOH and NaOH at 250° C. (482° F.) to form oxalates, adding calcium hydroxide to alkaline oxalate solution to produce insoluble calcium oxalate, decomposing this with sulphuric or hydrochloric acid; found natively in many plants (*Oxalis, Rumex, Rheum*, and other genera) as acid calcium or potassium oxalate, also in urine as calcium oxalate. It is in large, transparent, colorless crystals, soluble in water, alcohol, heated highly splits into H_2O,CO_2,CO—very poisonous.

FIG. 471.—Oxalic acid crystal.

PREPARATION.—1. *Tenth-normal Oxalic Acid Volumetric Solution.*

Manufacture: Dissolve purified oxalic acid 6.45 Gm., in distilled water q. s. 1000 cc. It must be standardized to contain 6.303 Gm.

PROPERTIES AND USES.—Poisonous, reducing agent, decolorizes permanganate solutions, precipitates gold and platinum solutions, removes iron stains from linen, paper, fabrics. Acid potassium oxalates under names *salt of sorrel, salt of lemon*, are also much used in decolorizing tissues of various kinds. Owing to close resemblance of oxalic acid to Epsom salt, fatal poisonings have resulted from mistaking the former for the latter.

Poisoning: Have vomiting, burning pain, constriction of throat and stomach, collapse, drowsiness, stupor, dark-colored discharges, death. Empty stomach, then give powdered chalk, whiting, or wall-plaster in water, slaked lime (lime water), dried whitewash, to form insoluble oxalate, hot fomentations to loins, enema, oil, abundant water, opium.

3. Tribasic Fatty Acids.

(These acids have 3 hydrogen atoms replaceable by metals.)

Acidum Citricum. Citric Acid, *U.S.P.*—(Syn., Acid. Cit., Acidum Citri—Limonis—Limonum—Limonorum; Fr. Acide (du Citron) citrique; Ger. Acidum citricum, Zitronensäure, Citronsäure.)

$$H_3C_6H_5O_7 + H_2O = \begin{matrix} CH_2COOH \\ | \\ C(OH).COOH \\ | \\ CH_2COOH \end{matrix} + H_2O = C_3H_4 \begin{matrix} OH \\ CO_2H \\ CO_2H \\ CO_2H \end{matrix}$$

Manufacture: This tribasic organic acid occurs in juices of plants, especially in their fruit, as strawberry, raspberry, cherry, currant, lemon, lime, gooseberry, whortleberry, cranberry, tamarind, tomato, etc.; it is usually prepared from the juice of limes or lemons by first clarifying by ebullition, neutralizing with chalk and washing the resulting calcium citrate with boiling water, in which it is sparingly soluble, decomposing with diluted sulphuric acid; strain out calcium sulphate, concentrate, allow to crystallize in wooden vats lined with lead—(1) $2H_3C_6H_5O_7 + 3CaCO_3 = Ca_3(C_6H_5O_7)_2 + 3CO_2 + 3H_2O$. (2) $Ca_3(C_6H_6O_7)_2 + 3H_2SO_4 = 2H_3C_6H_5O_7 + 3CaSO_4$. It is in colorless, translucent crystals, white powder; odorless; acid taste; efflorescent in warm air; soluble in water (.5), boiling water (.5), alcohol (1.8), ether (30); contains 99.5 p. c. of $H_3C_6H_5O_7.H_2O$.

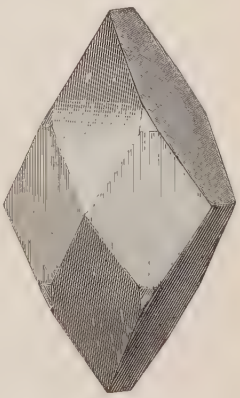


Fig. 472.—Citric acid crystal.

Tests: 1. Aqueous solution (1 in 10) acid, which, rendered alkaline by calcium hydroxide T. S.—remains clear, but, on boiling, becomes opaque (calcium citrate). 2. Slowly ignited, decomposes without odor of burning sugar (dif. from tartaric acid). 3. Neutralize aqueous solution (1 in 10) with ammonia T. S., add 5 drops diluted hydrochloric acid, cool, + calcium chloride T. S.—clear (abs. of oxalic acid); ash .05 p. c. *Impurities:* Heavy metals, lead, oxalic, sulphuric, tartaric acids. Dose, gr. 5–30 (.3–2 Gm.).

Preparations.—1. *Syrupus Acidi Citrici.* Syrup of Citric Acid, *U.S.P.* (Syn., Syr. Acid. Cit.; Fr. Sirop (d'Acide citrique) de Limon; Ger. Citronsäuresirup.)

Manufacture: 1 p. c. Dissolve citric acid 1 Gm. in distilled water 1 cc., add it to syrup 95 cc., mix well; add tincture of lemon peel 1 cc., shake, add syrup q. s. 100 cc., mix thoroughly. Should be kept in containers previously washed with boiling water, and not dispensed if it has a terebinthinate odor or taste or shows other deterioration. Dose, ʒj–4 (4–15 cc.).

2. *Liquor Magnesii Citratis,* 35 Gm. per bottle (350 cc.).

3. *Potassii Citras Effervescens,* 16.2 p. c. 4. *Syrupus Aurantii,* .5 p. c. 5. *Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, N.F.,* .07 p. c. 6. *Liquor Ferri Citratis, N.F.,* 37.5 p. c. 7. *Liquor Ferri Salicylatis, N.F.,* .85 p. c. 8. *Liquor Phosphatum Compositus, N.F.,* 12 p. c. 9. *Liquor Sodii Citratis, N.F.,* 2 p. c. 10. *Liquor Sodii Phosphatis Compositus, N.F.,* 13 p. c. 11. *Sal Carolinum Factitium Effervescens, N.F.,* 25 p. c. 12. *Sal Kissingense Factitium Effervescens, N.F.,* 25 p. c. 13. *Sal Lithii Citratis Effervescens, N.F.,* 19.5 p. c. 14. *Sal Magnesii Sulphatis Effervescens, N.F.,* 13.6 p. c. 15. *Sal Potassii Bromidi Effervescens Compositum, N.F.,* 25 p. c. 16. *Sal Vichyanum Factitium Effervescens, N.F.,* 25 p. c.

Properties and Uses.—Irritant, antiscorbutic, stimulant, diuretic, refrigerant; rheumatism, hemorrhage, jaundice, scurvy, fevers, antidote to alkaline and narcotic poisons, good locally for diphtheritic angina, gangrenous sore mouth, jaundice, pruritus, cancerous tumors, reduces obesity, prolonged usage emaciates.

Acidum Lacticum. Lactic Acid, $HC_3H_5O_3$, *U.S.P.*—(Syn., Acid. Lact., Isolactic, Ethyledene-lactic, or Oxypropionic Acid; Fr. Acide lactique; Ger. Acidum lacticum, Milchsäure.) A liquid containing lactic acid and lactic anhydrides equivalent to 85–90 p. c. of $HC_3H_5O_3$. This is the second member of a group of monobasic diatomic acids which contain two hydroxyl groups, the hydrogen in one (the upper, COH_2) being replaceable by alcohol, that of the other (lower, CO_2H) by metals:

$$CH_3 \begin{cases} CHOH{=}COH_2 \\ COOH{=}CO_2H \end{cases}$$

Manufacture: Lactic acid occurs in gastric juice, urine, intestinal juices, many plant juices, sour milk, sour cabbage, and is produced from sugar by the special lactic ferment (*Bacte'rium lac'tis*). Allow lactose (milk sugar), or inverted sugar, milk, or cheese and water to undergo fermentation, at 25–35° C. (77–95° F.), neutralize acid as fast as formed with chalk or zinc oxide, as butyric acid will be produced if much free lactic acid present, recrystallize resulting calcium or zinc lactate, decompose with sulphuric acid or hydrogen sulphide, evaporate filtrate. It is a colorless, slightly yellow, syrupy liquid, nearly odorless, acid taste and reaction; absorbs moisture on exposure: miscible with water, alcohol, ether; insoluble in chloroform, petroleum benzin, carbon disulphide; sp. gr. 1.206; cannot be distilled without decomposi-

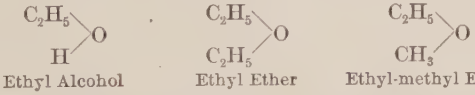
tion. *Tests:* 1. Add to 2 cc. of equal volumes of lactic and sulphuric acids, potassium permanganate .1 Gm., heat gently—aldehyde odor. 2. Ash .006 Gm. *Impurities:* Heavy metals, chloride, sulphate, readily carbonizable substances, sugars, citric, oxalic, phosphoric, sarcolactic, tartaric acid. Should be kept in glass-stoppered bottles. Dose, ʒss–2 (2–8 cc.), in lemonade; if by enema, the acid should be neutralized by sodium bicarbonate.

PREPARATIONS.—1. *Elixir Calcii Lactophosphatis, N.F.,* 3 p. c. 2. *Elixir Glycerophosphatum Compositum, N.F.,* 1 p. c. 3. *Elixir Pepsini Compositum, N.F.,* $\frac{1}{10}$ p. c. 4. *Elixir Pepsini et Rennini Compositum, N.F.,* $\frac{1}{5}$ p. c. 5. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.,* $\frac{3}{5}$ p. c. 6. *Syrupus Calcii Lactophosphatis, N.F.,* 6 p. c.

PROPERTIES AND USES.—Caustic, large doses hypnotic, stomachic. Lactic acid has gained its popularity from the fact of its being one of the constituents of the gastric juice, etc. Given in dyspepsia, phosphatic deposits, tuberculous diarrhea, green infantile diarrhea, diabetes, rheumatism, otitis, ulcers of nasal fossæ, diphtheria, croup, insomnia, caustic to fungous caries, lupus, epithelioma, ulcers, tuberculous ulcers, laryngeal and pharyngeal affections (morbid growths, etc.).

V. Ethers.

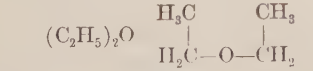
These are formed from alcohols by replacing the hydrogen of hydroxyl by the same or other alcohol radicals, thus:



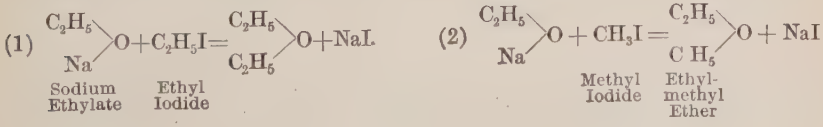
Ethyl Alcohol — Ethyl Ether — Ethyl-methyl Ether

Ethers are the oxides of alcohol radicals or residues, and these latter may be alike or different, thus giving simple or mixed ethers.

Æther. Ether, *U.S.P.*—(Syn., Æther Fortior, Æther Sulphuricus, Hydric Ether, Naphtha Vitrioli, Hydrate of Ethylen, Oxide of Ethyl, Ethyl Oxide; Fr. Ether hydrique—vinique—sulfurique; Ger. Äther, Schwefeläther.) A liquid containing 96–98 p. c. of ethyl oxide, $(C_2H_5)_2O$ the remainder consisting of alcohol and water.



Manufacture: 1. By action of chloride or iodide of hydrocarbon residue upon an alcohol in which the hydrogen of hydroxyl has been replaced by a metal:



2. By action of sulphuric acid on alcohol, whereby 1 molecule of water is abstracted from 2 molecules of alcohol; this is the general process, and consists in distilling together alcohol and sulphuric acid at about 130° C. (266° F.), passing the vapors through two purifiers, one of cast iron containing solution potassium hydroxide to remove water and other impurities, the other of block-tin containing pebble-stones to recondense alcoholic and other vapors of higher boiling-points than ether.

$$C_2H_5OH + H_2SO_4 = \underset{\text{Ethylsulphuric acid.}}{C_2H_5HSO_4} + H_2O$$

This ethylsulphuric acid acts upon another alcohol molecule, giving ether—$C_2H_6HSO_4 + C_2H_5OH = (C_2H_5)_2O + H_2SO_4$. This process, in theory, is continuous, the H_2SO_4, last formed again acting on fresh alcohol as it is supplied; in practice this is not true, as the H_2SO_4 becomes, after a time, so weak from the accumulated water, which never entirely goes over, that it will not act upon the alcohol. Each gallon (4 L.) of alcohol yields about 4 pounds (2 Kg.) of ether. It is a transparent, colorless, mobile liquid; characteristic odor; burning, sweetish taste; soluble in water (12) with slight contraction of volume; miscible with alcohol, chloroform, petroleum benzin, benzene, fixed or volatile oils, highly volatile and inflammable, its vapor mixed with air and ignited may explode violently; slowly oxidizes by air, moisture and daylight into peroxides; sp. gr. 0.715; boils at 35° C. (95° F.). *Tests:* 1. Does not change dampened blue litmus to red in 10 minutes. 2. Spontaneous evaporated residue moistened—odorless, neither reddens nor bleaches blue litmus. 3. Evaporate 50 cc. —residue .001 Gm.; evaporated from blotting paper—no foreign odor at the last traces. *Impurities:* Acid, aldehyde, peroxides. Should be kept cool, remote from fire in partially filled, well-closed, light-proof containers (preferably tin cans); when for anesthesia should be dispensed only in small, well-closed containers, and not used after the latter have been opened 24 hours. Dose, ℥v–60 (.3–4 cc.).

Preparations. —1. *Collodium*, 75 p. c. 2. *Oleoresina Aspidii*, q. s. 3. *Oleoresina Capsici*, q. s. 4. *Pilulæ Phosphori*, q. s. 5. *Mistura Chloroformi et Morphinæ Composita, N.F.*, 3¼ p. c.

6. *Oleum Æthereum. Ethereal Oil, N.F.* Add slowly sulphuric acid 1000 cc. to alcohol 1000, mix thoroughly, after 24 hours, distil until oily drops cease to come over (until black froth forming on surface begins to rise; separate yellow ethereal liquid from distillate, expose it for 24 hours, transfer to wet filter, wash oil with cold distilled water 25 cc., when drained add to oil equal volume of ether.

Prep.: 1. *Spiritus Ætheris Compositus. Hoffmann's Anodyne, N.F.*, ethereal oil 2.5 cc., ether 32.5, alcohol 65. Dose, ℥v–60 (.3–4 cc.).

7. *Oleum Phosphoratum, N.F.*, 10 p. c. 8. *Spiritus Ætheris, Hoffmann's Drops, N.F.*, ether 32.5 cc., alcohol q. s. 100 cc. Dose, ℥xv–60

(1–4 cc.). 9. *Pilulæ Ferri Iodidi, N.F.* q. s. 10. *Tinctura Ferri Chloridi Ætherea, N.F.*, 25 p. c.

PROPERTIES.—Internally—acts like chloroform or alcohol, cardiac stimulant, anesthetic, narcotic, carminative, antispasmodic. Externally—irritant, local anesthetic, stimulant, refrigerant. The heart, vasomotor and respiratory centers are paralysed much less easily by ether than by chloroform; ether, however, is a more intense renal and bronchial irritant, also more likely to induce vomiting and a more protracted stage of stimulation, hence more struggling.

USES.—Internally—nausea, dyspepsia, flatulent and biliary colic, neuralgia of the gums, earache, fainting, cardiac failure or palpitation, asthma; here more rapid than chloroform in action, hence for these cases it is better. Ether is inhaled to blunt sensibility in surgical operations, to relax muscles in dislocations, strangulated hernia, neuralgia, biliary and renal colic, dysmenorrhea, tetanus, spasms, asthma, chronic bronchitis, labor, extracting teeth, headache, vomiting of pregnancy, hysteria, tenia, biliary calculi, whooping-cough, spasmodic croup, delirium tremens, mania, lumbago, sciatica, collapse in opium and chloral hydrate poisoning, convulsions. Should inhale ether slowly through the nostrils, on empty stomach, and watch the pulse closely. If beats become slow, feeble, or quick, the sponge should at once be removed; best inhaled from sponge fixed in a paper cone having the larger end over the face and the smaller end cut off to admit a small amount (30 p. c.) of air. It requires about ℥ij (60 cc.) and 5–15 minutes to produce insensibility. On recovery have more nausea and vomiting than follows chloroform, which may be checked by sodium bromide gr. 15 (1 Gm.); should not use it at night, and never near flame or fire. One death occurs from every 16,000 inhalations. Externally—headache, toothache, earache, neuralgia, deafness, photophobia, hernia, hiccough, malignant pustule, carbuncle, tonsillitis. Also may freeze by ether part to be operated upon, and thus deaden pain. The two spirits are useful in sleeplessness, restlessness, nervous disturbance, hysteria, flatulent and uterine colic.

Incompatibles: Arterial sedatives, strychnine, picrotoxin.

Synergists: Arterial and cerebral stimulants, chloroform, alcohol, etc.

Allied Product:

1. *Æther Aceticus. Acetic Ether. Ethyl Acetate*, $C_2H_5C_2H_3O_2$, *N.F.*—This liquid, composed of 96 p. c., by volume, of ethyl acetate, $C_2H_5C_2H_3O_2$, the remainder consisting of alcohol and a little water, is obtained by setting aside 1–2 days, in a well-closed flask, alcohol 63 Gm. and sulphuric acid 111 Gm., in order to form ethylsulphuric acid, adding this to a retort containing powdered anhydrous sodium acetate 82 Gm., heating retort on water-bath, condensing vapors in a well-cooled receiver—$C_2H_5OH + H_2SO_4 = C_2H_5HSO_4 + H_2O$; $C_2H_5HSO_4 + NaC_2H_3O_2 = C_2H_5C_2H_3O_2 + NaHSO_4$; purify (from acetic acid, alcohol, water) by shaking with one-third volume of aqueous solution containing 20 p. c. of sodium chloride and 2 p. c. of sodium carbonate (acetic acid),

decanting carefully the ethereal layer, shaking with freshly ignited potassium carbonate (water), distilling (alcohol). It is a transparent, colorless liquid, fragrant, refreshing, slightly acetous odor, peculiar acetous, burning taste, volatile, inflammable (yellowish flame acetous odor), sp. gr. 0.893, boils at 74.5° C. (166° F.), soluble in water (10), miscible with alcohol, ether, fixed or volatile oils. *Impurities:* Butyric or amylic derivatives, readily carbonizable organic substances, excess of alcohol or water. Stimulant, antispasmodic, carminative, acts like ether but has a more pleasant taste; syncope, nervous agitation, colic, flatulence; inhaled for laryngeal and bronchial irritation, nervous cough; externally—same as ether. Should be kept cool, dark, remote from lights or fire, in well-stoppered bottles. Dose, ♏xv–30 (1–2 cc.), well diluted; 1. *Elixir Gentianæ Glycerinatum, N.F.*, $\frac{1}{20}$ p. c. 2. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.*, $\frac{1}{5}$ p. c. 3. *Liquor Ferri Peptonati, N.F.*, $\frac{1}{50}$ p. c. 4. *Liquor Ferri Peptonati et Mangani, N.F.*, $\frac{1}{50}$ p. c. 5. *Spiritus Odoratus, N.F.*, $\frac{1}{5}$ p. c. 6. *Tinctura Antimonii, N.F.*, $\frac{1}{5}$ p. c.

Spiritus Æthylis Nitrosi. Spirit of Ethyl Nitrite, $C_2H_5NO_2$, *U.S.P.*—(Syn., Sp. Æth. Nitrit., Spiritus Ætheris Nitrosi, U.S.P. 1910, Spirit of Nitrous Ether, Sweet Spirit of Nitre, Spiritus Nitri Dulcis, Ethyl Nitrite, Spiritus Nitrico-Ätherеus; Fr. Éther azoteux alcoolisé, Liqueur anodine nitreuse; Ger. Spiritus Aetheris nitrosi, Versüsster Salpetergeist.) An alcoholic solution of ethyl nitrite, $C_2H_5NO_2$, containing 3.5–4.5 p. c. of ethyl nitrite.

Manufacture: Mix sulphuric acid 40 cc. with water 120 cc., cool, add diluted alcohol 170 cc., pour into a 1000 cc. flask, surrounded by ice and water; dissolve sodium nitrite 100 Gm. in water 280 cc., filter, pour into a separatory funnel, let slowly drop into flask containing acid mixture, when reaction complete allow crystals, if any, to settle, decant quickly cold mixture of ethyl nitrite and aqueous solution to the previously cooled separatory funnel, draw off and discard aqueous liquid; wash separated ethyl nitrite with ice-cold water 20 cc., then with ice-cold water 15 cc. containing monohydrated sodium carbonate .6 Gm. (to remove traces of acid), separate ethyl nitrite from aqueous liquid, agitate it in well-stoppered bottle with potassium carbonate 3 Gm. (to remove traces of water), cool, decant immediately ethyl nitrite into a tared bottle containing alcohol 500 Gm.; ascertain weight of ethyl nitrite by noting increase in weight of tared bottle and contents, add alcohol q. s. to make mixture weigh 22 times the weight of ethyl nitrite added. It is a clear, mobile, volatile, inflammable liquid, pale yellow, faintly greenish-yellow, fragrant, ethereal, pungent odor free from acridity; sharp, burning taste; neutral, but acid by age; sp. gr. 0.823. *Tests:* 1. Must not effervesce upon adding a crystal of potassium bicarbonate (abs. of free acid). 2. Immerse a test-tube half-filled with it in a water-bath at 65° C. (149° F.)—when that temperature acquired it boils upon adding a few small pieces of broken

glass. *Impurities:* Aldehyde, free acid, etc. Should be kept cool, dark, remote from fire, in small, well-stoppered, dark amber-colored bottles. Dose, ʒss–2 (2–8 cc.).

Preparations.—1. *Mistura Glycyrrhizæ Composita*, 3 p. c. 2. *Mistura Copaibæ, N.F.*, 12.5 p. c. 3. *Mistura Copaibæ et Opii, N.F.*, 25 p. c.

Unoff. Prep.: Liquor Ethyl Nitritis (Br.), ethyl nitrite 2.5-3 p. c. (+ alcohol 95, glycerin 5), dose, ♏xx–60 (1.3–4 cc.).

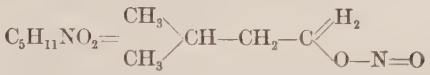
Properties.—Diffusible stimulant, stomachic, carminative, diaphoretic, diuretic, anesthetic, antispasmodic, antipyretic.

Uses.—Febrile condition to promote sweating, strangury, urinary and kidney affections, flatulence, nausea, nervous agitation, coughing, headache, chronic bronchitis, fevers, in ordinary cold, followed by hot lemonade, chronic Bright's, cardiac (angina pectoris), and pulmonary diseases.

Incompatibles: Potassium iodide, ferric sulphate, mucilage of acacia, tincture of guaiac(um), antipyrine, emulsions, tannin, gallic acid.

Synergists: Diaphoretics, diuretics, antispasmodics, potassium citrate, tincture of aconite, etc.

Amylis Nitris. Amyl Nitrite, $C_5H_{11}NO_2$, *U.S.P.*—(Syn., Amyl. Nitris, Amyl Æther Nitrosus, Amylonitrous Ether; Fr. Azotite d'Amyl, Ether amylozoteux; Ger. Amylium nitrosum, Amylnitrit.) A liquid containing 80 p. c. of amyl (chiefly iso-amyl) nitrite.



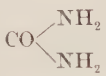
Manufacture: Distil sodium nitrite, amyl alcohol, and diluted sulphuric acid, collecting that vaporizing at 95–100° C. (203–212° F.); wash distillate with ice-cold solution of sodium carbonate (to remove acid), dehydrate with anhydrous potassium carbonate, redistil below 100° C. (212° F.)—$2C_5H_{11}OH + 2NaNO_2 + H_2SO_4 = 2C_5H_{11}NO_2 + Na_2SO_4 + 2H_2O$; or distil equal volumes pure amyl alcohol, nitric acid and copper—$C_5H_{11}OH + HNO_3$ (deoxidizing into HNO_2) = $C_5H_{11}NO_2 + H_2O$. It is a clear, yellowish liquid, peculiar, ethereal, fruity odor, pungent, aromatic taste, almost insoluble in water, miscible with alcohol, ether, volatile even at low temperatures, inflammable, yellow luminous sooty flame; sp. gr. 0.870. *Tests:* 1. 2 drops + 2 drops of water + 2 cc. sulphuric acid—amyl valerate, recognized by odor on dilution with water. 2. Add few drops to 1 cc. of ferrous sulphate T. S. + 5 cc. of diluted hydrochloric acid—greenish-brown. *Impurities:* Free acid, aldehyde. Should be kept cool, dark, in hermetically sealed glass bulbs, or tightly-stoppered vials. Dose, ♏j–3 (.06–.2 cc.), cautiously inhaled from a handkerchief in which a glass tear (capsule) containing the amyl nitrite has been crushed. Internally give ♏ss 1 (.03–.06 cc.), dissolved in alcohol.

Properties.—Motor and nervous depressant—sedative (spinal cord), antispasmodic, anodyne, diuretic; most rapid-acting drug—1–2 minutes. Produces flushed dusky face, fulness in head (bursting), roaring in ears, complete muscular relaxation (falling to ground), excessive heart action (rapid, strong) from depression of vagus, rapid dyspneic breathing, reduced temperature and blood-pressure from dilatation of arterial muscular coat, which lessens resistance and causes rapid heart beats; giddiness, dilated pupils—death by respiratory paralysis.

Uses. –To relax spasms in arteries (arterial pressure), hence depressant, to control convulsions, and relieve asthmatic paroxysms—angina pectoris, functional or slight organic heart disease, asthma, convulsions following labor, spasmodic dysmenorrhea, tetanus, hysterical convulsions, epileptic paroxysms, neuralgia, headache, whooping-cough, hiccough, vomiting of pregnancy, syncope, faintness, hepatic and renal colic, spasm of the glottis, vertigo, pneumonia, intermittent fever, night-sweats, chorea, infantile convulsions, hydrophobia, chordee, exophthalmic goiter, chloroform syncope, sea-sickness, strychnine, chloral hydrate, cocaine, and severe carbonic acid poisoning, insomnia from opium habit. Externally—as an anodyne in headache, toothache, earache, neuralgia, dysmenorrhea; fetor of gangrene, secretions, and exudations modified by its solution. Should not be used where there is profuse hemorrhage, or when there is serious organic heart or brain disease (degeneration of arteries).

3. Urea Derivatives.

Carbonic Acid



Carbamide

Urea (carbamide) is carbonic acid with its 2 hydroxyls replaced by 2 ammonia residues, NH_2, as shown above.

Barbitalum. Barbital, $[CO(HN.CO)_2C(C_2H_5)_2] = C_8H_{12}O_3N_2$, *U.S.P.*—(Syn., Barbital, Diethylbarbituric Acid, Barbitone, Veronal, Veronalum, Diethylmalonylurea; Br. Barbitonum, Malonurea; Fr. Diethylmalonylureé; Ger. Diäthylbarbitursäure.)

Manufacture: Chemically related to urea—prepared by heating together for several hours at 108° C. (226° F.), urea, diethylmalonic acid and sodium alcoholate, thereby forming sodium diethylbarbiturate (alcohol being liberated), then decomposing the salt with hydrochloric acid. It is in colorless, white crystals, white crystalline powder, odorless, slightly bitter taste, permanent, soluble in acetone, ethyl acetate, water (130), alcohol (14), chloroform (75), ether (35), boiling water (13); acid to litmus; melts at 188° C. (370° F.); ash—negligible. *Tests:* 1. Aqueous saturated solution + mercuric nitrate T. S.—white precipitate, soluble in excess of reagent. 2. Boiled with excess of sodium carbonate T. S. for 30 minutes, or fused with sodium hydroxide—decomposed with evolution of ammonia. *Impurities:* Readily car-

bonizable substances. Dose, gr. 5–15 (.3–1 Gm.), in hot water, tea or milk, capsules, wafers, followed by some warm drink; not in pill.

PREPARATION.—1. *Barbitalum Solubile.* Soluble Barbital. (Syn., Barbital Sol., Barbital Sodium, Diethylbarbiturate, Sodium Diethylmalonylurea, Barbitone Sodium, Veronal Sodium, Veronal Soluble; Ger. Diäthylbarbitursaures Natrium, Medinal.)

Manufacture: By the action of a sodium compound on diethylbarbituric acid producing a mono-sodium salt more soluble in water and containing 89.3 p. c. of barbital and 98.5 p. c. of pure salt. It is a white powder, odorless, bitter taste, permanent, soluble in water (5), boiling water (2.5), slightly in alcohol, insoluble in ether; melts at 188° C. (370° F.), aqueous solution (1 in 20) alkaline; with diluted hydrochloric or sulphuric acid—precipitate (barbital). *Tests* and *Impurities;* —similar to barbital. Dose, gr. 5–15 (.3–1 Gm.).

PROPERTIES AND USES.—Hypnotic, somnificant, sedative; insomnia, especially that accompanying hysteria, neurasthenia, mental disturbance; chorea, sea-sickness; no effect on respiration, circulation, kidneys. Normal dose produces several hours of sleep without any unpleasant after-effect. *Poisoning:* Abnormal doses may depress respiratory center, produce profound stupor, fever, skin eruptions, death; while gr. 15 (1 Gm.) have proved fatal, recoveries have been from ℥ijss (10 Gm.)—wash out stomach, treat symptoms.

Phenobarbitalum. Phenobarbital, $CO(NH.CO)_2C(C_2H_5)(C_6H_5)$, *U.S.P.* —(Syn., Phenobarb., Phenylethylmalonylurea; Ger. Phenyläthylbarbitursäure, Luminal.)

Manufacture: Differs from barbital in that an ethyl group has been replaced by a phenyl group; phenylethyl barbituric acid is obtained by condensing phenylethyl malonic acid derivatives and urea. It is in white, glistening small crystals, white crystalline powder, odorless, permanent; soluble in solutions of alkali hydroxides or carbonates, water (1000), alcohol (8), chloroform (40), ether (13), benzene (700); melts at 173° C. (343° F.), saturated aqueous solution acid; ash—negligible. *Tests:* 1. Boil .2 Gm. with 5 cc. of a 25 p. c. sodium hydroxide solution—ammonia evolved. 2. Shake .3 Gm. for 2 minutes with 1 cc. normal sodium hydroxide + 5 cc. distilled water, add to filtrate (*a*) mercuric chloride T. S.—white precipitate, (*b*) silver nitrate T. S., few drops at a time,—white precipitate; at first redissolves, but with excess becomes insoluble. *Impurities:* Phenylbarbituric acid, readily carbonizable substances. Dose, gr. ½–3 (.03–.2 Gm.).

PROPERTIES AND USES.—Hypnotic, sedative; especially for epilepsy, but like bromides it is more palliative than curative, undoubtedly rendering convulsions less frequent and severe. In large quantity toxic, depressing circulation and occasioning death.

Related Product:

1. *Æthylis Carbamas. Ethyl Carbamate. Urethanum. Urethane,* $C_3H_7O_2N$, U.S.P. 1900–1910.—Obtained by heating together urea nitrate and ethyl alcohol for several hours in a steam digester at 120–

130° C. (248–266° F.). The resulting crystalline mass is dissolved in water, shaken out with ether, after recovering ether residue is distilled and crystallized from water, $(NH_2)_2COHO_3N + C_2H_5OH = CONH_2.OC_2H_5 + NH_4NO_3$. It is in colorless columnar crystals, scales, odorless, cooling, saline taste, soluble in water (.45), alcohol (.8), glycerin (2.5), chloroform (.9), ether (1.5), olive oil (32); melts at 48° C. (119° F.); incinerate 2 Gm.—ash .05 p. c.; aqueous solution (1 in 20) neutral. Hypnotic (unreliable) without unpleasant after-effects; resembles paraldehyde in action; overdoses depress spinal cord, heart, and respiration, death due to asphyxia; used in nervous or functional insomnia, or that due to mental or physical depression, chronic alcoholism, insanity. Dose, gr. 10–40 (.6–2.6 Gm.).

Procainæ Hydrochloridum. Procaine Hydrochloride, $[NH_2(C_6H_3CO)OC_2H_4N(C_2H_5)_2.HCl]$, *U.S.P.*—(Syn., Procain. Hydrochl., Novocaine, Ethocaine, Syncaine; Ger. Novocain hydrochloricum, Para-aminobenzoyl-diäthylaminoäthanol hydrochlorid.)

Manufacture: Heat ethylene chlorhydrine with paranitrobenzoyl chloride, and the resulting chlor-ethyl paranitrobenzoic ester is heated 24 hours under pressure at 120° C. (248° F.) with diethylamine producing the diethylaminoethyl ester of paranitrobenzoic acid which is then reduced by zinc and hydrochloric acid to procaine from which the hydrochloride is easily obtained. It is in small, colorless crystals, white crystalline powder, odorless, permanent; soluble in water (.6), alcohol (30), slightly soluble in chloroform, almost insoluble in ether; melts at 155° C. (311° F.), ash—negligible. *Tests:* 1. Aqueous solution (1 in 20) neutral, + silver nitrate T. S.—white precipitate, insoluble in nitric acid, soluble in ammonia water. 2. Aqueous solution (1 in 10) with (*a*) gold chloride T. S., (*b*) iodine T. S., (*c*) mercuric potassium iodide T. S., (*d*) picric acid T. S.—precipitates; with solution of sodium bicarbonate—unchanged, with sodium hydroxide or carbonate T. S.—colorless, oily precipitate, crystalline on standing. *Impurities:* Heavy metals, phenacaine, cocaine hydrochloride, readily carbonizable substances.

Preparation.—1. *Liquor Procainæ Hydrochloridi. Dental Anesthetic Solution, N.F.*, 2 p. c., procain. hydrochl. 2 Gm., sod. chlorid. .92, thymol .02, aq. dest. steril. q. s. 100 cc.; to each cc. add .05 cc. liq. epineph. hydrochlor. just prior to using. Should be preserved in bottles of resistant glass.

Properties and Uses.—Local anesthetic, our best for intradermal, neural, or spinal anesthesia, not so good for surface use, non-irritant to mucous membranes or other tissues; similar to cocaine, but does not cause hyperemia or necrosis of tissues, and much less toxic than it or any of its other substitutions; in spite of its safety and efficiency deaths have occurred in its use. Dose, infiltration anesthesia—gr. 4 (.2 Gm.) with physiological salt solution ℨ1.6–3.2 (50–100 Gm.), with or without suprarenal alkaloid solution (1 in 1000) ♏v–10 (.3–.6 cc.); for

injections—gr. 1.5 (.1 Gm.) in salt solution gr. 75–150 (5–10 Gm.), with or without suprarenal alkaloid solution (1 in 1000) ♏x (.6 cc.); ophthalmology—1–5–10 p. c. solutions; rhino-laryngology 5–20 p. c. solutions with suprarenal alkaloid solution ♏vi-8 (.4–.5 cc.) in each ♏clx (10 cc.); internally—gr. 5–8 (.3–.5 Gm.).

Novorenal—name applied to sterilized solutions of various strengths of novocaine + adrenalin in normal salt solution for dental surgery.

Æthylis Aminobenzoas. Ethyl Aminobenzoate, $C_6H_4NH_2.COO(C_2H_5)$ 1:4, *U.S.P.*—(Syn., Æthyl. Aminobenz., Benzocaine, Anesthesin, Anesthesinum, Anesthone, Ethyl paramidobenzoate, Paramidobenzoic acid ethyl ester; Ger. Anästhesin, p-Aminobenzoesäureäthylester.)

Manufacture: Heat para-nitrobenzoic acid with sodium sulphide and solution of sodium hydroxide, cool, acidulate, boil to expel SO_2, add sodium acetate to produce crystallization of paramidobenzoic acid which is esterfied by heating with alcohol and sulphuric acid. It is in small white, colorless crystals, white crystalline powder, odorless, tasteless, but benumbing the tongue, permanent, soluble in dilute acids, water (2500), alcohol (5), chloroform (2), ether (4), expressed oil of almond or olive oil (30–50), melts at 89° C. (192° F.); ash .1 p. c. boiled with alkali hydroxides—liberates alcohol. *Tests:* 1. Dissolve .02 Gm. in 10 cc. distilled water + few drops diluted hydrochloric acid, add 5 drops of 10 p. c. sodium nitrite solution, then 2 cc. of a solution of .1 Gm. betanaphthol in 5 cc. sodium hydroxide T. S.—orange-red precipitate. 2. Aqueous solution (1 in 50) with slight excess of diluted hydrochloric acid, + iodine T. S.—precipitate, and reduces instantly potassium permanganate T. S. *Impurities:* Heavy metals, arsenic, chloride, free acid, readily carbonizable substances, *Incompatibles:* Alkalies and their carbonates. Dose, gr. 5–8 (.3–.5 Gm.), pastilles, dusting powder (pure or diluted), ointment (10 p. c.), combined with adrenalin—"Anesthone Cream," suppositories.

Properties and Uses.—Substitute for cocaine—local anesthetic, similar in action to orthoform, but free from irritation and toxicity; owing to insolubility effect is more prolonged than cocaine, and cannot be used hypodermically. Locally—more effective when skin is broken—in rhinologic and laryngeal affections, urethritis, anesthetizing abraded surfaces, burns, ulcerations, painful skin affections, hemorrhoids, pruritus vulvæ, burns, wounds, tubercular laryngitis, coryza, hay fever, nasal asthma; internally to relieve pain of gastralgia, ulcer, and cancer of stomach.

II. AROMATIC SERIES.

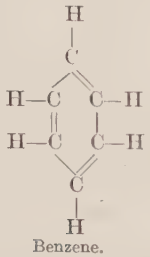
As previously stated, all organic compounds are either derivatives of methane, CH_4 (fatty series) or of benzene, C_6H_6 (aromatic series), and while these two parental compounds are strictly hydrocarbons, they as well as their derivatives are thoroughly distinctive, as they

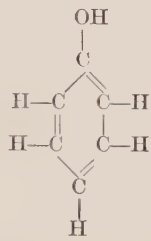
cannot in any sense be substituted for or converted into one another. The members of the fatty series, in a degree, are products that might be used as animal food; those of the aromatic series have not this power, being simply aromatics, antiseptics, stimulants. Many compounds of this latter series are obtained directly from the vegetable kingdom, while a great number result indirectly therefrom by destructive distillation of coal in the manufacture of illuminating gas, giving us coal-tar, *pix lithanthracis*, soluble in benzene, carbon disulphide, chloroform, ether; externally, antiseptic, parasiticide; chronic skin affections; ointment—5–10–20–30 p. c. When this coal-tar is distilled and the distillate caught in water, it separates into two layers—*light oil* floating on top of the water, *heavy oil* sinking below the water: from the former come benzene, etc.; from the latter, phenol (carbolic acid), etc.

Benzenum. Benzene, Benzol, Coal Naphtha. C_6H_6(Br.). A mixture of homologous hydrocarbons, chiefly benzene, C_6H_6, 70 p. c. + toluene C_6H_5,CH_3, 20–30 p. c.—Obtained by distilling coal-tar, when water and ammonia pass over along with 8–10 p. c. of a brown liquid, light oil; later the dead oil is obtained containing aniline, quinoline, naphthalene, phenol (carbolic acid), etc. The light oil contains benzene, toluene, xylene, isocumene, these being separated by fractional distillation, benzene coming over at 80° C. (176° F.), toluene at 110° C. (230° F.), which may be purified by exposing to a low temperature and expressing the portion remaining liquid. It is a thin, colorless, very inflammable liquid, coal-gas odor, sp. gr. 0.884, congeals at 0° C. (32° F.), soluble in ether, chloroform, acetone, alcohol (4), with nitric acid readily converted into nitrobenzene. *Impurities:* Acetylene, thiophene, carbon disulphide, toluene, xylene, etc. Antispasmodic, anticatarrhal, antizymotic, germicide, poisonous (causing uncertain gait, mental disturbance, wandering delirium, vertigo, loss of sexual power, epileptic convulsions, deep sleep). Used in whooping-cough, influenza; solvent for fats, volatile oils, resins, caoutchouc, sulphur, phosphorus, iodine, alkaloids (quinine, etc.). Its principal use, however, is in the manufacture of aniline, and therefrom the many important coal-tar products. Dose, ℿx–30 (.6–2 cc.), emulsion, on sugar, in capsule; locally mixed with 9 parts of soapsuds.

Phenol. Phenol, C_6H_5OH, *U.S.P.*—(L. fr. Gr. *φαίνειν*, to show, or *φοῖν(ιξ)*, purple-red + *ol*(eum).). (Syn., Carbolic Acid, Acidum Carbolicum, Acidum Phenicum—Phenylicum (Crystallizatum), Phenic—Phenylic Acid, Phenylic Alcohol, Benzophenol; Fr. Acide carbolique—phénique, Hydrate de Phényle; Ger. Phenolum, Karbolsäure, Phenylsäure, (Phenylalkohol.) This hydroxybenzene, obtained from coal-tar or made synthetically, is the hydroxide of the hydrocarbon benzene, and according to the number of hydrogen atoms replaced by the hydroxyl, OH, we have mon-, di-, tri-atomic, etc., phenols. This hydroxyl here

is acid whereas that in alcohols is basic; the phenols differ from alcohols in not yielding aldehydes or acids by oxidation and in having hydroxyl (OH) that is acid.


Benzene.


Phenol (Carbolic Acid).

Manufacture: Phenol occurs in castoreum, urine and in products of dry distillation of bones, resins and wood, especially coal; that portion of coal-tar coming over at 100–250° C. (212–482° F.) is known as *light oil*, sp. gr. 0.940–0.990, and contains phenol 4–10 p. c. This fraction is agitated with a 10 p. c. solution sodium hydroxide (stronger solution undesirable, as it would dissolve also naphthalene, etc.), and upon standing separates into two layers—lower, being a solution of sodium-phenol—upper, consisting of the extracted oil; draw off and treat lower layer with hydrochloric or sulphuric acid sufficient for exact decomposition; the impure phenol thus liberated rises to the surface as an oily layer, which is removed and washed by agitation with concentrated solution sodium chloride, freed from water by calcium chloride, then distilled at 180–190° C. (356–374° F.); expose distillate to cold, when phenol congeals in crystalline mass, which freed from adhering liquid is again distilled at 185° C. (365° F.) and crystallized. Sometimes before final distillation it is treated with potassium dichromate and sulphuric acid, and to get colorless loose crystals may recrystallize from boiling petroleum benzin. Phenol may also be obtained from the *heavy oil*, collecting that portion coming over at 160–220° C. (320–428° F.), then treating distillate as above. Phenol may be obtained synthetically from benzene (benzol) by treating with sulphuric acid, heating—$C_6H_6 + H_2SO_4 = C_6H_5SO_2OH + H_2O$; the resulting benzene-sulphonic acid is neutralized with potassium carbonate, yielding potassium benzene-sulphonate, and this compound fused with excess of potassium hydroxide—$2(C_6H_5SO_2OK) + 4KOH = 2H_2O + 2K_2SO_3 + 2C_6H_5OK$, the latter, potassium-phenol, is treated with solution hydrochloric acid, which liberates phenol, to be purified by distillation—$C_6H_5OK + HCl = C_6H_5OH + KCl$. This process has the advantage of yielding phenol free from cresol, xylene, etc., as benzene can be used of absolute purity. It is in colorless, interlaced, or separate needle-shaped crystals, or white, crystalline mass, sometimes acquiring reddish tint, characteristic, aromatic odor, copiously diluted with water sweetish taste, slightly burning aftertaste, when undiluted cauterizes and whitens skin and mucous mem-

brane, soluble in water (15), alcohol, glycerin, chloroform, ether, carbon disulphide, fixed or volatile oils; petrolatum or liquid petrolatum; aqueous solution (1 in 15) clear, neutral, faintly acid, liquefied by gentle heat, forming a highly refractive liquid, or by 8 p. c. of water, congeals at 39° C. (102.2° F.); contains 98 p. c. of pure phenol. *Tests:* 1. Aqueous solution with bromine water—white precipitate (tribromphenol), at first redissolving, but permanent with more reagent, appearing crystalline under the microscope. 2. Aqueous solution (1 in 100) 10 cc. + 1 drop of ferric chloride T. S.—violet-blue liquid. 3. Heat on water-bath 5 Gm.—volatilizes with residue .05 p. c.; vapor inflammable. Should be kept dark, in well-closed containers. Dose, gr. ½–1 (.03–.06 Gm.).

Preparations.—1. *Phenol Liquefactum.* Liquefied Phenol. (Syn., Phenol Liq., Liquefied Carbolic Acid, Acidum Carbolicum Liquefactum; Ger. Verflussigte Karbolsäure.)

Manufacture: Liquefy phenol, a convenient quantity, by placing unstoppered container in water-bath, apply heat gradually until it is melted, transfer liquid to a tared vessel, weigh and then for each 9 Gm. of phenol add 1 Gm. of distilled water, mix thoroughly. It is a colorless liquid, which may develop a red tint upon keeping, characteristic, aromatic odor, when undiluted cauterizes and whitens the skin and mucous membrane; miscible with alcohol, ether, glycerin; when diluted with equal volume of glycerin becomes miscible with water, sp. gr. 1.065, boils at 182° C. (360° F.); contains 88 p. c. of pure phenol. Should be kept dark, in well-closed containers. Dose, ♏ss–1 (.03–.06 cc.).

Preps.: 1. *Aqua Phenolata, N.F.*, 2⅕ p. c. 2. *Liquor Iodi Phenolatus, N.F.*, ⅗ p. c., mix phenol liq. .6 cc., liq. iodi co. 1.5, glycerin 16.5, water q. s. 100 cc. 3. *Liquor Sodii Boratis Compositus, Dobell's Solution, N.F.*, $\frac{3}{10}$ p. c. 4. *Lotio Calaminæ Composita, N.F.*, 1 p. c.

2. *Glyceritum Phenolis.* Glycerite of Phenol. (Syn., Glycer. Phenol., Glycerite of Carbolic Acid; Br. Glycerin of Phenol; Fr. Glycéré d'Acide phénique, Glycérine phénique; Ger. Phenol (Phenylglycerit.)

Manufacture: 20 p. c. Dissolve sodium citrate 1 Gm. in boiling distilled water 1 cc. and add this solution to a previously prepared mixture of liquefied phenol 20 cc. and glycerin 79. Dose, ♏ij–5 (.13–.3 cc.).

3. *Unguentum Phenolis.* Ointment of Phenol. (Syn., Ung. Phenol., Ointment of Carbolic Acid; Br. Unguentum Acidi Carbolici, Phenol Ointment; Fr. Pommade (d'Acide) phénique; Ger. Phenolsalbe.)

Manufacture: 2 p. c. Melt yellow wax 5 Gm. + phenol 2 Gm. on a water-bath, add petrolatum 93 Gm.—stir until congealed. 4. *Nebula Aromatica, Aromatol, N.F.*, ⅕ p. c., phenol, menthol., āā .2 Gm., eucalyptol, ol. cinnam., ol. caryoph., āā .2 cc., camphor, acid. benz., āā .3 Gm., thymol .1, methyl. salicyl. .5 cc., light petrolat. liq. q. s. 100 cc. 5.

Odontalgicum, Toothache Remedy, N.F., 33 p. c. 6. *Oleum Phenolatum, Carbolized Oil, N.F.*, 5 p. c., phenol 5 Gm., olive oil 95. 7. *Petroxolinum Phenolis, N.F.*, 5 p. c. 8. *Petroxolinum Phenolis Camphoratum, N.F.*, 12.5 p. c., phenol 12.5 Gm., camphor 37.5, petrox. liq. q. s. 100 cc. 9. *Phenol Iodatum, N.F.*, 60 p. c. 10. *Pulvis Antisepticus, N.F.*, $\frac{1}{10}$ p. c.

Unoff. Preps.: Suppositoria Acidi Carbolici (Br.), each 1 gr. (.06 Gm.). *Trochiscus Acidi Carbolici* (Br.), each $\frac{1}{2}$ gr. (.03 Gm.).

Properties.—Internally—sedative, antifermentative, antipyretic, irritant, poisonous. Externally—antizymotic, antiseptic, disinfectant, deodorant, anesthetic, irritant caustic. Rapidly destroys animal and vegetable organized ferments, also those organisms causing septic diseases, thereby preventing the formation of their decomposition products. In the stomach is converted into a sulphophenolate, but may circulate as an alkaline phenolate. Diminishes the production of heat and increases its dissipation, renders urine dark.

Uses.—Internally—vomiting, diarrhea, flatulent dyspepsia, typhoid and intermittent fevers, scarlatina. Externally—in spray, ulcers, gangrene, phthisis, chronic bronchitis, whooping-cough, diphtheria, erysipelas, pain of burns, polypi, venereal abscesses, boils, carbuncles, hemorrhoids, varicose veins, goiter, hydrocele, sore nipples, granular ophthalmia, otorrhea, earache, surgical operations, freckles, acne, prurigo, ringworm, warts, bee-stings, sore throat, toothache, rheumatism, bunions, diabetes.

Poisoning: Have burning sensation, collapse, cold, clammy skin, weak pulse, feeble, shallow breathing, urine dark green, white eschars from lips, mouth, etc., vomiting, purging, dizziness, low temperature, contracted pupils, insensibility, comatose, death. Give quick emetic—apomorphine hypodermically—or wash out stomach with alcohol ℥ij–4 (60–120 cc.) diluted with an equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; may follow with magnesium or sodium sulphate (℥j; 30 Gm. + water ℥viij; 240 cc.), then stimulants, ether, brandy, atropine and strychnine hypodermically, digitalis, coffee, demulcent drinks (no oils or glycerin), opium, apply hot-water bottle, bag, or blankets, etc.

Incompatibles: Alcohol, bromine, soapsuds, albumin, metallic salts, antipyrine, collodion, alkalies, lime, soluble sulphates, atropine.

Synergists: Antiseptics, motor depressants.

Creosotum. Creosote, $C_7H_8O_2 + C_8H_{10}O_2$, *U.S.P.*—(Gr. κρέας, flesh, + σώζειν, to preserve—*i. e.*, its preserving properties.) (Syn., Creosot., Creasote; Fr. Créosote; Ger. Kreosotum, Kreosot.) A mixture of phenols and phenol derivatives, chiefly guaiacol, $C_7H_8O_2$, and creosol, $C_8H_{10}O_2$, obtained from wood tar.

Manufacture: The wood-tar is distilled until one-half has passed over, the distillate separating into a *light* and a *heavy* oily layer, with an intervening aqueous acid stratum; the light oil contains eupion, etc.;

to the heavy oily layer add strong Na_2CO_3 solution (to remove acid constituents) and then distil the separated oily liquid, that portion of the distillate being collected which is heavier than water; this distillate is treated with KOH solution, sp. gr. 1.12, whereby the creosote is dissolved and eupion separated, now add H_2SO_4, wash well the precipitated creosote and distil at 200–220° C. (392–428° F.); treatment with potassium hydroxide and sulphuric acid is repeated until potassium creosote solution no longer turns brown upon heating in the air. Creosote can be obtained from pyroligneous acid by saturating with sodium sulphate at 70° C. (158° F.), skimming off supernatant oily layer, distilling it and treating distillate with sodium carbonate. It varies in composition according to method and wood used, and consists chiefly of acid methylic ethers of catechol (guaiacol) and its homologues—guaiacol, creosol, phlorol (xylenol), $C_6H_{10}O$, methyl-creosol, $C_6H_{12}O_2$, methyl-guaiacol, $C_8H_{10}O_2$. It is an almost colorless, yellowish, highly refractive oily liquid, penetrating, smoky odor, burning, caustic taste, not readily brown on exposure to light, slightly soluble in water, miscible with alcohol, ether, fixed or volatile oils, neutral or faintly acid, sp. gr. 1.076; begins to distil at 200° C. (392° F.), between which and 220° C. (428° F.) 90 p. c. passes over; inflammable, burning with luminous, smoky flame. *Tests:* 1. Saturated aqueous solution 10 cc., + 1 drop of ferric chloride T. S.—violet-blue, very transient, cloudy, passing rapidly from grayish-green to muddy brown, finally a brown precipitate. 2. Add equal volume of collodion in a dry test-tube—no permanent coagulum (abs. of phenol, and so-called "coal-tar creosote"). 3. 2 cc. requires 10–18 cc. of normal sodium hydroxide V. S. to produce clear liquid, add 50 cc. of distilled water—not cloudy (abs. of hydrocarbons and bases). *Impurities:* Phenol, coal-tar creosote, hydrocarbons and bases, cærulignol and other high-boiling constituents of wood-tar. Should be kept in tightly stoppered, dark amber-colored bottles. The substance known as *coal-tar creosote* has a different composition, being impure phenol, made from coal-tar, consequently is more poisonous and should not be substituted for creosote. Dose, ♏j–10 (.06–.6 cc.).

Preparations.—1. *Creosoti Carbonas.* Creosote Carbonate. (Syn., Creosot. Carb.; Fr. Carbonate de Creosote; Ger. Kreosotum carbonicum, Kreosotkarbonat, Creosotal.)

Manufacture: This mixture of the carbonate of various constituents of creosote, chiefly guaiacol and creosol, is made by passing a current of carbon oxychloride into solution of creosote in sodium hydroxide solution, washing separated oil with dilute sodium hydroxide solution and finally with water. It is a clear, colorless, yellowish, viscid liquid, odorless, tasteless, slight odor and taste of creosote; on prolonged exposure to cold crystals of guaiacol carbonate separate, which redissolve on warming; soluble in alcohol, petroleum benzin, fixed oils, insoluble in water, miscible with chloroform, benzene, sp. gr. not below 1.145; contains 90 p. c. of creosote, and is analogous to guaiacol carbonate.

Tests: 1. Heat for a few minutes .5 cc. with 10 cc. of alcoholic potassium hydroxide T. S., cool—crystalline precipitate, which effervesces with acids. 2. Saturated alcoholic solution neutral, + 1 drop ferric chloride T. S.—only yellow color (abs. of free creosote); ash .1 p. c. Dose, ♏v–10 (.3–.6 cc.), in capsule, emulsion.

2. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.*, .44 p. c. 3. *Mulla Creosoti Salicylata, N.F.*, 20 p. c., + acid. salicyl. 10 p. c.

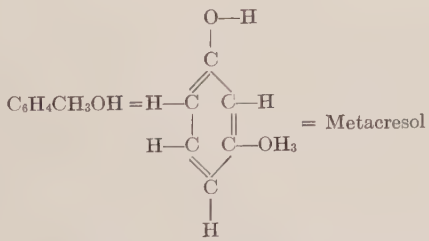
Unoff. Preps.: Aqua Creosoti, 1 p. c., *Unguentum Creosoti* (Br.), 10 p. c.

Properties and Uses.—Creosote—Internally, stimulating expectorant, antiseptic, parasiticide, anesthetic; nausea, vomiting, diarrhea, vomiting of pregnancy and of hysteria, cholera morbus, cholera infantum, fermentative dyspepsia, typhoid fever, dysentery, tapeworm, diabetes, polyuria, phthisis; locally—burns, chilblains, erysipelas, menorrhagia, uterine hemorrhage, leucorrhea, puerperal metritis, fetid otorrhea, diphtheritic sore throat, chronic empyema, toothache, gleet, ulcers, cancer, gangrene, mercurial stomatitis, glanders, ozena, itching, lupus, warts, condylomata, as a preservative of animal tissue. The water (aqua) used in leucorrhea, gleet, burns, ulcers, eczema, prurigo, etc. Creosote Carbonate—antitubercular, like creosote, but without its poisonous properties; it is well tolerated by the digestive system and is decomposed in the intestine, imparting a creosote odor to the breath and urine: phthisis (lessens fever and night-sweats), bronchitis, enteritis, ulceration, intestinal indigestion.

Poisoning: Same as for phenol.

Incompatibles: Strong sulphuric and nitric acid, reduces silver salts, exploding on contact with the oxide.

Cresol. Cresol, *U.S.P.*—(Syn., Cresolum, Cresylic Acid, Methylphenol, Tricresol, Oxytoluene; Fr. Cresol; Ger. Cresolum crudum, Rohes Kresol, Enterol.) A mixture of isomeric cresols (C_7H_8O or $C_6H_4CH_3.OH$) obtained from coal-tar.



Manufacture: Prepared from the "phenol" distillates of coal-tar between 140–220° C. (284–482° F.), by dissolving in sodium hydroxide solution, adding water and hydrochloric or sulphuric acid to separate hydrocarbons (benzene, naphthalene, toluene, etc.) and tarry matter;

to filtrate add hydrochloric acid to precipitate cresols, leaving phenol in solution, purify by solution in sodium hydroxide and distilling with hydrochloric acid at 180–200° C. (356–392° F.); consists of ortho-, meta-, and para-cresol. It is a colorless, yellowish, brown-yellow, pinkish, highly refractive liquid, darker or reddish with age and exposure to light, phenol-like, sometimes empyreumatic odor, dissolves in water (50), usually forming a cloudy solution, miscible with alcohol, ether, benzene, petroleum benzin, glycerin, solutions of fixed alkali hydroxides, sp. gr. 1.034. *Tests:* 1. Saturated aqueous solution, + ferric chloride T. S.—bluish-violet, neutral, slightly acid. 2. Solution of 1 cc. in 60 cc. of distilled water—only slightly turbid (abs. of hydrocarbons); 90 p. c. distils at 195–205° C. (383–401° F.). *Impurities:* Hydrocarbons, etc. Should be kept dark, in well-closed containers. Dose, ♏j–3 (.06–.2 cc.).

Preparations.—1. *Liquor Cresolis Compositus.* Compound Solution of Cresol. (Syn., Liq. Cresol. Co., Creolin; Fr. Soluté de Crésol composé; Ger. Liquor Cresoli saponatus, Kresolseifenlösung.)

Manufacture: Heat in a tared vessel on a water-bath at 70° C. (158° F.) cresol 50 cc. + linseed oil 35 cc., add potassium hydroxide 1.452 Gm. + sodium hydroxide 3.911 Gm. until a portion yields a clear solution with 9 volumes of cold water, cool, add water q. s. 100 cc.

2. *Orthocresol, N.F.*—The ortho variety of cresol obtained from coal-tar by restricting distillation at lowest cresol temperature, 188–194° C. (370–381° F.). It is in white crystals or colorless, yellow to brown highly refractive liquid, darker with age and exposure, phenol-like odor; soluble in alcohol, ether, chloroform, slightly in water, miscible with equal volume of solution of formaldehyde producing transparent solution; sp. gr. 1.05, melts at 30° C. (86° F.), boils at 190° C. (374° F.). Saturated solution neutral, slightly acid, + ferric chloride T. S.—blue-violet. Should be kept dark, in well-closed containers.

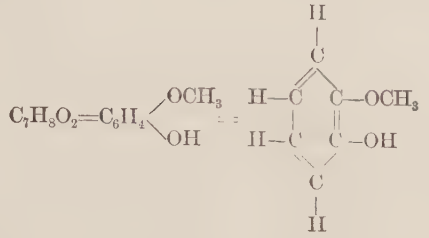
3. *Formaldehydum Cresolatum, N.F.*, orthocresol 40 cc. + solution formaldehyde 60 cc. Disinfectant; root canal work in dentistry, etc.

Properties and Uses.—Antiseptic, germicide, disinfectant; far less poisonous than phenol, the meta- being most powerful; as sodium cresylate, C_7H_7ONa, soluble in water, or by sulphonation with sulphuric acid have creolin, lysol, sapocresol, saprol, solutol, solveol, etc. Liquor—sometimes sold as lysol, phenolin, sapocresol, etc., in 1–5 p. c. solutions as vaginal and intra-uterine douches following labor, in chronic and acute inflammations of pelvic organs, urethral and vesical irrigations in urethritis, cystitis, ophthalmia, wounds, abscesses, ulcers, sterilize instruments, hands, etc.; renders parts soft, pliable, not harsh and rough as with mercuric chloride.

4. Di-hydroxy Phenol Derivatives.

Guaiacol. **Guaiacol**, *U.S.P.*—(Syn., Guaïacolum, Ortho-di-oxybenzene-methyl-ester, Methyl-orthodioxybenzene, Methyl-pyrocatechin,

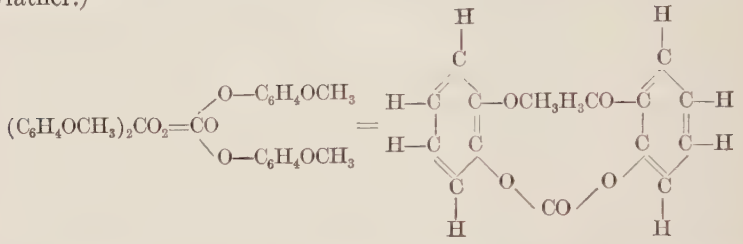
Pyrocatechin (Catechol)-monomethylether; Fr. Gaïacol; Ger. Guajakol.)



Manufacture: This monomethyl ether (ortho-dihydroxybenzene) is the chief constituent of creosote, and may be obtained (1) by distilling fractionally wood-tar creosote at 200–205° C. (392–401° F.), to get crude guaiacol, treating with ammonia to remove acid compounds, distilling, dissolving the lower boiling fraction in ether, treating with alcoholic solution of potassium hydroxide, to separate potassium guaiacol, $C_6H_4KOCH_3$, which is insoluble in ether, washing well with ether, crystallizing from alcohol, decomposing with sulphuric acid, rectifying the liberated guaiacol; (2) synthetically, by heating at 170–180° C. (338-356° F.) equal molecules of pyrocatechin, potassium hydroxide, potassium methyl-sulphate $C_6H_4(OH)_2 + KOH + KCH_3SO_4 = C_6H_4OHOCH_3 + K_2SO_4 + H_2O$, removing the resulting guaiacol by solution in alcohol or petroleum benzin, purifying by recrystallization; (3) by heating solution of metallic sodium, pyrocatechin, methyl iodide in methyl alcohol, freeing mixture from methyl alcohol, dissolving residue in sodium hydroxide solution, filtering, decomposing with hydrochloric acid; (4) by diazotizing and boiling ortho-anisidin with nitrous acid, decomposing the newly formed diazoanisol with sulphuric acid, distilling liberated guaiacol in a current of steam, redistilling, crystallizing. It is a colorless, yellowish, strongly refractive liquid or crystalline solid; odor agreeable, aromatic; darker on exposure to light and air; solid when liquefied, may remain so for some time, even at low temperature; melts at 28° C. (83° F.); dissolves in water (60–70), glycerin (1), from which it separates on adding water; miscible with alcohol, chloroform, ether, glacial acetic acid; sp. gr. liquid guaiacol 1.112; melted solid guaiacol 1.132; 85 p. c. distils at 200–210° C. (392–410° F.; ash .1 p. c. *Tests:* 1. Add to alcoholic solution (1 in 100) 10 cc. 1 drop of ferric chloride T. S.—an immediate blue color, changing to emerald-green, yellowish. 2. Shake 2 cc. with purified petroleum benzin 4 cc.—separates on standing into 2 distinct, clear layers; failure to separate or permanent turbidity indicates impurities (oily hydrocarbons, etc.). Should be kept dark, in well-closed containers. Dose, ♏ij–10 (.13–.6 cc.).

Preparations.—1. *Guaiacolis Carbonas.* Guaiacol Carbonate, *U.S.P.*—(Syn., Guaiacol. Carb., Duotal; Fr. Carbonate de Gaïacol;

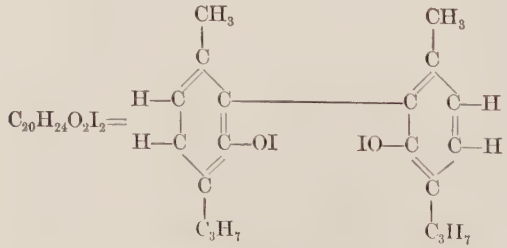
Ger. Guajacolum carbonicum, Guajakolkarbonat, Kohlensäure-Guajacyläther.)



Manufacture: Pass slowly carbonyl chloride, $COCl_2$ (phosgene gas), into guaiacol previously dissolved in sodium hydroxide solution, forming sodium chloride and guaiacol carbonate, the latter being insoluble separates, which is washed with solution sodium hydroxide, and crystallized from alcohol. It is a crystalline powder or small, colorless crystals, odorless, tasteless, slight aromatic odor and taste; soluble in alcohol (60), chloroform (1), ether (18), benzene, slightly in glycerin, fixed oils; insoluble in water, melts at 85° C. (185° F.). *Tests:* 1. Saturated alcoholic solution + ferric chloride T. S.—no bluish-green color (abs. of free guaiacol); not acid; ash .1 p. c. *Impurities:* Free guaiacol, readily carbonizable substances, etc. Dose, gr. 5–30 (.3–2 Gm.). 2. *Petroxolinum Guaiacolis, N.F.*, 20 p. c., + oleic acid 5, light petrox. liq. q. s. 100 cc.

Properties and Uses.—Expectorant, intestinal antiseptic—similar to creosote, but is less valuable and irritating to the intestinal canal and kidneys; phthisis, bronchitis, external tubercle, lupus, cough, expectoration, typhoid and other fevers, local anesthesia, neuralgia, antiseptic.

Thymolis Iodidum. Thymol Iodide, *U.S.P.*—(Syn., Thymol. Iod., Aristolum, Aristol. Dithymoldiiodide; Fr. Diiododithymol, Dithymol biiodé; Ger. Dithymoldijodid, Annidalin, Thymotol.) A mixture of iodine derivatives of thymol, principally dithymol-diiodide [$(C_6H_2.CH_3.C_3H_7.OI)_2$], containing not less than 43 p. c. of iodine.

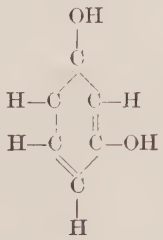


Manufacture: This is obtained by the condensation of 2 molecules of thymol, and the introduction of 2 atoms of iodine into the phenolic

groups of the thymol; potassium iodide being dissolved in a solution of iodine, and the thymol in a 12 p. c. solution of sodium hydroxide, the two solutions mixed, precipitate washed and dried; it is chiefly dithymol-diiodide, and contains, when dried to constant weight, 43 p. c. of iodine. It is a reddish-brown, reddish-yellow, bulky powder, slight, aromatic odor; insoluble in water, glycerin, cold or hot solutions of fixed alkali hydroxides, slightly soluble in alcohol, readily so in chloroform, ether, collodion, fixed or volatile oils (leaving slight residue). *Tests:* 1. Heat with sulphuric acid—decomposed with separation of iodine. 2. Dried to constant weight—loses 5 p. c.; incinerate .5 Gm. at low red heat—ash 1.5 p. c. *Impurities:* Alkalies, free iodine, soluble iodides. Should be kept dark, in well-closed containers.

PROPERTIES AND USES.—Antiseptic. Similar to and a substitute for iodoform in nasal, aural, and skin diseases (lupus, psoriasis, etc.), chronic rhinitis, balanitis, chancroids, ulcers, wounds, sores, tertiary syphilis. Apply in powder or ointment, with wool fat, flexible collodion, etc.

Resorcinol. **Resorcinol**, $C_6H_4(OH)_2$, *U.S.P.*—Fr. *res*(in) + *orc*(hella) + *in* + (phen)*ol*—*i. e.*, resinous and peculiarly colored phenol substance). (Syn., Resorcin., Metadihydroxybenzene; Fr. Résorcine; Ger. Resorcinum, Resorzin.)



Manufacture: While this diatomic phenol may be made by fusing different resins, as galbanum, guaiac(um), ammoniacum, asafetida, etc., with caustic alkalies, or by the reaction of fused sodium hydroxide upon sodium metabenzene disulphonate, it is obtained mostly by heating benzene with fuming sulphuric acid (4) at 257° C. (494° F.), forming benzene metadisulphonic acid, $C_6H_4(HSO_3)_2$, which is dissolved in water, neutralized with milk of lime, decomposed with sodium carbonate, the solution of sodium benzene-metadisulphonate evaporated to dryness, residue fused 8–9 hours with sodium hydroxide (2.5), yielding sodium resorcin(ol), $C_6H_4(ONa)_2$, and sodium sulphite; boil aqueous solution of saline mass to expell SO_2, extract tar-like residue with ether, distil, leaving impure resorcinol, which is purified by sublimation and recrystallization from water. It is in colorless, nearly colorless, needle-shaped crystals, or powder, faint, characteristic odor, sweetish, bitter taste, pinkish on exposure, soluble in glycerin, ether, water (.9), hot water (.2), alcohol (.9), slightly in chloroform, melts

at 110° C. (230° F.); aqueous solution (1 in 20) neutral, faintly acid; contains 99.5 p. c. of resorcinol. *Tests:* 1. Dissolve .1 Gm. in 2 cc. sodium hydroxide T. S., add 1 drop of chloroform, heat—intense crimson color, changing to a pale yellow on adding slight excess of hydrochloric acid. 2. Aqueous solution (1 in 20) gently warmed—no odor of phenol; ash .05 p. c. 3. Aqueous solution (1 in 200) 10 cc. + 3 drops of ferric chloride T. S.—bluish-violet, changing to brownish-yellow on adding ammonia T. S. (dif. from catechol and quinol). *Impurities:* Catechol, quinol, etc. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

Preparations.—1. *Pasta Resorcinolis Fortis, N.F.,* 20 p. c., + zinc oxide, starch, āā 20, light liquid petrolatum 40. 2. *Pasta Resorcinolis Mitis, N.F.,* 10 p. c., zinc oxide, starch, āā 25. 3. *Unguentum Resorcinolis Compositum, N.F.,* 6 p. c., + zinc oxide, bismuth subnitrate, rectified oil of birch tar, āā 6, + yellow wax 10, petrolatum 25, wool fat 28, glycerin 13. 4. *Curatio Paraffini, N.F.,* 1 p. c.

Properties and Uses.—Allied to phenol (carbolic acid); antiseptic, antipyretic, depressant; skin diseases, gastric ulcer, fermentative dyspepsia (an hour after food), vomiting, cholera infantum, diarrhea, rheumatism, typhoid fever, pneumonia, scarlatina, pleurisy, phthisis, cystitis, vomiting, sea-sickness. Solution in chronic otitis, gonorrhea, leucorrhea, whooping-cough, chronic aphonia, laryngeal ulcers, gangrene, morbid growths, boils, carbuncles, frostbites, ulcers, fissures, erysipelas, erythema, eczema, psoriasis, herpes, alopecia, chancres, papilloma, myomas, diphtheria; as the basis of dyes—resorcin-blue, -brown, -green, etc.

Poisoning: Same as for phenol (carbolic acid).

Acidum Salicylicum. Salicylic Acid, $C_6H_4(OH).COOH$ 1:2., or $HC_7H_5O_3$, *U.S.P.*—(Syn., Acid. Salicyl., Ortho-oxybenzoic Acid; Fr. Acide salicylique; Ger. Salizylsäure.) This acid (orthohydroxybenzoic) exists naturally in combination in various plants (gaultheria, betula, etc.)—the best, but generally is prepared synthetically—least expensive, most popular. It may be obtained (1) by fusing salicin with potassium hydroxide; (2) by heating (saponification) oil of gaultheria with potassium hydroxide until all methyl alcohol is given off, decomposing the potassium salicylate with hydrochloric acid; (3) by saturating phenol with sodium hydroxide, producing sodium phenolate (carbolate), C_6H_5ONa, drying this compound and treating it with carbon dioxide—$C_6H_5ONa + CO_2 = NaC_6H_5CO_3$; put this into retort, heat to 130° C. (226° F.) and pass into it carbon dioxide, thereby converting it into sodium salicylate, $NaC_7H_5O_3$, which is dissolved in water, decomposed with hydrochloric acid, drained, washed with cold water, dissolved in boiling water, yielding crystals upon cooling; purify by dissolving in diluted alcohol, decolorizing with animal charcoal, recrystallizing. It is in fine needles, bulky, crystalline powder; yellowish, pinkish; slight gaultheria-like odor; sweetish, acrid taste; permanent; synthetic—

white and odorless; soluble in water (460), boiling water (15), alcohol (2.7), chloroform (42), ether (3), acetone (3), benzene (135), oil of turpentine (52); acid reaction, melts at 158° C. (316.4° F.); contains 99.5 p. c. of $HC_7H_5O_3$; 138 grains correspond to 169 grains of oil of gaultheria. *Tests:* 1. Saturated aqueous solution + ferric chloride T. S.—bluish-violet, violet-red; ash—.05 p. c. 2. Dissolve 1 Gm. in excess of cold sodium carbonate T. S., + ether (1), agitate—evaporated ethereal residue, if any, should be free from phenol odor. *Impurities:* Coloring matter, chloride, phenol, readily carbonizable substances. Dose, gr. 5–20 (.3–1.3 Gm.).

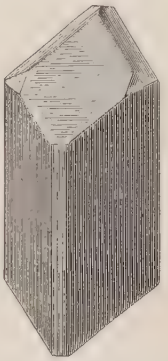


Fig. 473.—Salicylic acid crystal.

Preparations.—1. *Collodium Salicylicum Compositum, Corn Cure, N.F.*, 10 p. c. + fldext. cannabis 10 cc., flexible collodion q. s. 100. 2. *Glycerogelatinum Acidi Salicylici, N.F.*, 10 p. c., + glycerin, dist. water, āā 35, glycerinated gelatin 20. 3. *Mulla Acidi Salicylici, N.F.*, 10 p. c. + benzoinated suet 80, benzoinated lard 10. 4. *Mulla Creosoti Salicylata, N.F.*, 10 p. c., + creosote 20, yellow wax 5, benzoinated suet 65. 5. *Stili Acidi Salicylici, N.F.*, 10 p. c., + tragacanth 5, starch 30, white dextrin 35, sucrose 20, dist. water q. s. for firm plastic mass (to make 40–45 pencils). 6. *Elixir Manacæ Compositum, N.F.*, 5.5 p. c. 7. *Pasta Zinci, (Lassar's)*, 2 p. c., + zinc oxide, starch, āā 24, petrolatum 50. 8. *Pulvis Antisepticus, N.F.*, ½ p. c. 9. *Pulvis Talci Compositus, N.F.*, 3 p. c., + boric acid 10, talc 87.

Properties.—Antiseptic, disinfectant, antipyretic, antiperiodic, stimulant, diuretic, cardiac depressant—arrests enzymic fermentation. Small doses stimulate the stomach, heart, respiration; large doses derange stomach, causing nausea, vomiting, reduce respiration, heart action, temperature, and arterial tension. By gastro-intestinal secretions converted into sodium salicylate, and as such enters circulation; it is eliminated by kidneys and skin mainly as salicyluric acid.

Uses.—Rheumatic fever, migraine, sciatica, diabetes, cystitis, diphtheria; externally—skin diseases, eczemas, warts, corns, excess of epidermis; it, or salts—dangerous food preservative.

Salicylism is the result of excessive doses of salicylates, and resembles *cinchonism* from quinine. It is manifested by headache, deafness, ringing in the ears, sweating, weak pulse and respiration, nausea, delirium, vomiting, etc., and can be prevented by preceding each dose with a small quantity of alcoholic stimulant.

Poisoning: Give emetics, diffusible stimulants, atropine, strychnine, artificial heat. Same as for acetanilid.

Incompatibles: Arterial and cerebral stimulants: alkalies, mineral acids, metallic salts (especially ferric), spirit of ethyl nitrite.

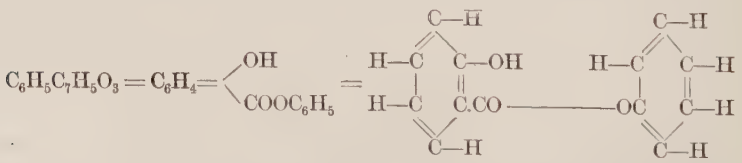
Synergists: Phenol (carbolic acid) derivatives, anesthetics, cardiac and cerebral depressants.

Acidum Acetylsalicylicum. Acetylsalicylic Acid, $C_6H_4.O(CH_3CO).COOH$ 1:2, *U.S.P.*—(Syn., Acid. Acetylsal., Aspirin, Aspirinum; Fr. Acide Acetylsalicylique; Ger. Acidum acetylosalicylicum, Azetylsalizylsäure).

Manufacture: By prolonged heating together: salicylic acid (50) and acetic anhydride or acetyl chloride (75) at 150° C. (302° F.), recrystallizing from chloroform. It is in small, colorless crystals, needles, white crystalline powder, odorless, acidulous taste, permanent in dry air, in moist decomposed into salicylic and acetic acids; soluble in water (300), alcohol (5), chloroform (17), ether (10–15), less soluble in absolute ether, soluble with decomposition in solutions of alkali hydroxides and carbonates; melts at 132° C. (270° F.); ash .05 p. c.; contains 99.5 p. c. of pure salt. *Tests:* 1. Heat with water several minutes, add 1–2 drops ferric chloride T. S.—violet-red color. 2. Boil for a few minutes .5 Gm. with 10 cc. sodium hydroxide T. S., cool, add 10 cc. diluted sulphuric acid—white precipitate of salicylic acid, with acetic acid odor; to filtrate add 3 cc. alcohol + 3 cc. sulphuric acid, warm—odor of ethyl acetate. *Impurities:* Heavy metals, chloride, sulphate, free salicylic acid, coloring matter, resinous and readily carbonizable substances. Should be kept in well-closed containers. Dose, gr. 5–15 (.3–1 Gm.), capsules, wafers, dry on tongue, or dissolved in sweetened water, ter die.

Properties and Uses.—Analgesic, antipyretic, antirheumatic; rheumatism, neuralgia, myalgia, headache, neuritis, rheumatic fever, acute tonsillitis, skin diseases. Similar to but better than salicylic acid as it produces less undesirable effects (tinnitus, etc.), owing to the slow liberation of salicylic acid. Overdoses may produce not only ringing in the ears, but also profuse sweating, cold extremities, with or without lowering body temperature, rapid or irregular pulse, albuminuria, edema of face, mouth, throat, urticaria, bronchial asthma. It is decomposed in the intestine, not in the stomach.

Phenylis Salicylas. Phenyl Salicylate, $C_{13}H_{10}O_5$, *U.S.P.*—(Syn., Phenyl. Salicyl., Salol; Fr. Salicylate de Phénol (Phényle); Ger. Phenylum salicylicum, Phenylsalizylat, Salolum, Salicylsäurephenylester.)



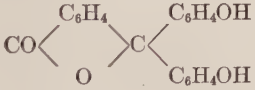
Manufacture: This phenylester of salicylic acid may be obtained by several processes: 1, Treat sodium phenol(ate) + sodium salicylate with a dehydrating agent, as phosphorus oxychloride, or with a slow current of phosgene (carbonyl chloride)—$2C_6H_5ONa + 2C_6H_4(OH)CO_2Na + POCl_3 = 2C_6H_4(OH)CO_2C_6H_5 + 3NaCl + PO_3Na$; dissolve

resulting salol in alcohol, crystallize; 2, heat salicylic acid in an atmosphere of carbon dioxide—(1) $2HC_7H_5O_3$ + heat = $(C_6H_4CO_2H)_2O$ + H_2O. (2) $(C_6H_4CO_2H)_2O$ = $C_6H_5C_7H_5O_3$ + CO_2. It is changed first into its anhydride and then into phenyl salicylate; dissolve in alcohol, crystallize. It is a white, crystalline powder, aromatic odor, characteristic taste, soluble in chloroform, ether, benzene, fixed or volatile oils, water (6670), alcohol (6), melts at 42° C. (108° F.). *Tests:* 1. Alcoholic solution (1 in 20) + diluted ferric chloride T. S.—violet color. 2. Dissolve .3 Gm. in 3 cc. of hot sodium hydroxide T. S., acidify with hydrochloric acid—salicylic acid separates and phenol odor recognized; incinerate—ash .05 p. c. *Impurities:* Uncombined phenol or salicylic acid, free acid, chloride, sulphate. Should be kept cool, in well-closed containers. Dose, gr. 5–30 (.3–2 Gm.), pill, capsule, emulsion, or milk.

Properties.—Antiseptic, antipyretic, antirheumatic.

Uses.—Rheumatism, neuralgia, lancinating pains, one of the best intestinal antiseptics for duodenal catarrh, indigestion, fermentation; diarrhea, dysentery, cholera, ulcers, ozena, diphtheria, gonorrhea, otorrhea, vesical catarrh, fermentative dyspepsia, typhoid fever, cystitis, substitute for iodoform in surgery. Salol in the small intestine splits into phenol 36 p. c. and salicylic acid 64 p. c., consequently salol is more dangerous than salicylic acid from the presence of phenol, which latter colors the urine dark. Death has been occasioned by gr. 15 (1 Gm.), and by gr. 120 (8 Gm.), in each case signs of phenol (carbolic acid) poisoning being present.

Phenolphthaleinum. Phenolphthalein, $C_{20}H_{14}O_4$, *U.S.P.*,—(Syn., Phenolphthal., Dihydroxyphthalophenone, Dioxythiphenylphthalide, Paraphthalein; Fr. Phénolphtaléine; Ger. Phenolphthalein.)



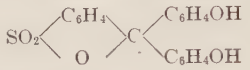
Manufacture: This dibasic phenol derivative is obtained by heating phenol (10), phthalic anhydride (5), and sulphuric acid (4) at 120° C. (248° F.) for 10 hours, boiling product with water, dissolving residue in sodium hydroxide solution, precipitating phenolphthalein with acetic acid; purify by washing, dissolving in alcohol, boiling, with animal charcoal, reprecipitating with water. It is a white, faintly yellowish-white, crystalline powder, odorless, tasteless, permanent, soluble in alcohol (13), ether (70), solutions of alkali hydroxides and hot solutions of alkali carbonates, red—yielding red liquid (decolorized by excess of acids or heating with zinc dust), almost insoluble in water, melts at 256° C. (493° F.); ash .05 p. c. *Impurities:* Heavy metals, arsenic, fluorane. Dose, gr. 1.5–3 (.1–.2 Gm.), powder, tablet, capsule, cachet, pill; gr. 8 (.5 Gm.) given with safety in obstinate cases but gr.

15 (1 Gm.) have poisoned; with sugar and vanilla as proprietary—*Purgen*, etc.

PREPARATION.—1. *Tabellæ Phenolphthaleini, N.F.*, 1 gr., + cocoa 1, sucrose 3, gluside $\frac{1}{50}$, sp. cinnam. $\frac{1}{50}$ m.

PROPERTIES AND USES.—Cathartic, laxative, action mild, efficient, 4–8 hours, soft discharges without much griping; uncomplicated acute and chronic constipation; base of many proprietary purgatives; indicator in volumetric analysis.

Phenolsulphonphthaleinum. Phenolsulphonphthalein. $(C_6H_4OH)_2CO.C_6H_4SO_2$, *U.S.P.*—(Syn., Phenolsulphonphthal, Phenol Red.)



Manufacture: By the reaction of phenol and sulphobenzoic acid anhydride at 130° C. (266° F.) for 24 hours, and differs from phenolphthalein in having an SO_2 group instead of the CO group. The o-sulphobenzoic acid anhydride is prepared by distilling the free acid obtained from the acid ammonium salt with P_2O_5, the acid ammonium salt being obtained from gluside; then producing phenol sulphonphthalein by fusion of o-sulphobenzoic anhydride with phenol. It is a crystalline powder, bright to dark red, permanent, soluble in solutions of alkali hydroxides, carbonates, ammonia water, solutions of ammonium carbonate, deep red to violet according to strength, deep color changed to orange or yellow by slight excess of acid; solution in alkali hydroxides decolorized by warming with zinc dust; soluble in water (1300), alcohol (350), acetone (500), almost insoluble in chloroform and ether; loses on drying 1 p. c.; ash .2 p. c. *Impurities:* Arsenic, etc. Dose, gr. $\frac{1}{10}$ (.006 Gm.).

PROPERTIES AND USES.—Diagnostic reagent; to test, by intramuscular injection, the functional capacity of the kidney, by noting the length of time required and degree of color imparted. In health the dye appears in urine within 5–10 minutes being eliminated in 2 hours, whereas in nephritis, etc., this function is delayed—insufficient healthy kidney structure.

Trinitrophenol. Trinitrophenol, $C_6H_2(OH)(NO_2)_3$, *U.S.P.*—(Syn., Trinitrophen., Picric Acid, Acidum Picricum (Carbozoticum), Carbozotic (Nitrophenisic) Acid; Fr. Acide picrique (carbazotique, nitroxaothique); Ger. Pikrinsäure, Trinitrocarbolsäure.)

Manufacture: Formerly by action of nitric acid on indigo, silk, leather, wool, aloe, benzoin, salicin, etc.; now by mixing phenol and sulphuric acid equal parts, and after phenolsulphonic acid forms, adding nitric acid, constantly stirring, crystallizing; may purify by removing adhering acid in a centrifuge, dissolving in sodium hydroxide solution, decomposing sodium picrate with hydrochloric acid, crystallizing, recrystallizing. It is in pale yellow, rhombic prisms, scales, odorless, intensely bitter taste; explodes when heated rapidly, or subjected to percussion; soluble in water (78), boiling water (15),

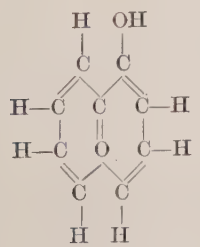
alcohol (12), chloroform (35), ether (65), benzene (10); aqueous solution —acid, melts at 122° C. (252° F.). *Tests:* 1. Aqueous solution (1 in 100)—yellowish, darker with alkalies, red with ammonium sulphide T. S. or solution of an alkaline cyanide. 2. Dissolve 2 Gm. in 50 cc. of benzene—the washed and dried insoluble residue .2 p. c. *Impurities:* Sulphate, etc. For safety in transportation usually mixed with 10–20 p. c. of water, and before applying tests should be dried to constant weight over sulphuric acid. Should be kept cool, remote from fire, in well-stoppered bottles. Dose, gr. ½–2 (.03–.13 Gm.): ammonium picrate (best salt), gr. ½ (.03 Gm.), ter die.

Properties and Uses.—Antiseptic, germicide, astringent, analgesic, antiperiodic, parasiticide, poisonous; externally may irritate skin, causing eczema; solution locally in fungous endometritis, erysipelas, burns, wounds, ulcers, eczema, hyperidrosis (feet), injury to cornea, conjunctivitis, trachoma (2 p. c. ointment), lymphangitis, fissured nipples, burns, scalds (1 + alcohol 10, + water 730); in surgery use —½–1 p. c. solution; in skin diseases—aqueous solution or moistened gauze, for sweating feet—2 p. c. in powdered talc; disadvantage—powerful staining property; solution in water (1 in 100) precipitates (test) alkaloids (except aconitine, caffeine, cocaine, coniine, hyoscyamine, morphine, theobromine); popular yellow dye, modified into green with indigo or Prussian blue.

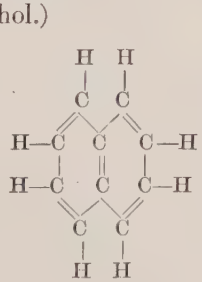
Poisoning: Imparts color to urine and all tissues, irritates mucous membrane, from necrosis due to precipitation of albumin in the tissues, produces low temperature, vomiting (yellow), abdominal pain, diarrhea (yellow), white blood corpuscles increased, red partly dissolved or decomposed forming methemoglobin, eyes yellow, skin itches as in jaundice, great weakness, stupor, collapse, convulsions, death, Wash-out stomach thoroughly, enema; antidote—egg white, milk; glucose freely, as it produces a less injurious substance; poisonous dose, gr. 30 (2 Gm.), but recovery has occurred from ℥jss (6 Gm.).

5. Naphthalene Derivatives.

Betanaphthol. **Betanaphthol,** $C_{10}H_7OH$, *U.S.P.*—(Gr. *β*, second letter of alphabet—Beta + *νάφθα*; L. *naphth*(a) + *ol*(eum)—*i. e.*, second of several isomeric compounds from this origin.) (Syn., Betanaph., Naphthol, Naphtol, Beta-mono-hydrox-naphthalene, Iso-naphtol; Fr. *β*-Naphthol; Ger. Naphtholum, *β*-Naphthol.)



Betanaphthol, $C_{10}H_7OH$.



Naphthalene, $C_{10}H_8$.

Manufacture: This monohydroxyphenol of the naphthalene series occurring in coal-tar usually is prepared artificially from naphthalene by heating it with sulphuric acid to form α- and β-naphthalenesulphonic acids, $C_{10}H_7HSO_3$, the former, produced at about 90° C. (194° F.), being converted into the latter at higher temperature; dissolve in water, saturate with milk of lime to form calcium naphthalenesulphonates which crystallize out; dissolve this in water and decompose by sodium carbonate to get corresponding sodium salts, now fuse with sodium hydroxide, yielding sodium naphthol and sodium sulphite, when the former may be treated with hydrochloric acid to form sodium chloride and betanaphthol, which is purified by sublimation and recrystallization from water; it bears the same relation to naphthalene as does phenol to benzene. It is in colorless, pale buff, shining crystalline leaflets (laminæ), or white, yellowish-white crystalline powder, faint phenol-like odor, permanent, soluble in water (1000), boiling water (80), alcohol (.8), chloroform (17), ether (1.3), glycerin, olive oil, alkali hydroxide solutions, melts at 121° C. (250° F.), sublimes, volatilizes with the vapors of alcohol or water; hot saturated aqueous solution neutral. *Tests:* 1. Cold saturated aqueous solution + ammonia water—faint bluish fluorescence; + ferric chloride T. S.—greenish, slowly separating whitish flakes, brownish on heating. 2. Add .1 Gm. to 5 cc. of aqueous solution of potassium hydroxide (1 in 4), + 1 cc. of chloroform, warm gently—aqueous layer blue, green, brown; ash .05 p. c. *Impurities:* Naphthalene, alphanaphthol, other organic substances. Should be kept dark, in well-closed containers. Dose, gr. 2–5 (.13–.3 Gm.).

Preparations.—1. *Pasta Betanaphtholis, N.F.*, 10 Gm. + precip. sulphur 50, petrolatum, soft soap, āā 20. 2. *Petroxolinum Betanaphtholis, N.F.*, 10 Gm. + liquid petroxolin q. s. 100 cc. of product.

Properties and Uses.—Antiseptic (intestinal), antifermentative, deodorizer, stimulant; enteritis, fermentation, typhoid fever, ozena, eczema, prurigo, herpes, favus, conjunctivitis, chronic laryngitis, otitis, ringworm, psoriasis, scabies, abscesses, acne, diarrhea, dysentery. Apply in alcoholic solution, 1–2 p. c., or ointment, 10–15 p. c.

Allied Product:

1. *Naphthalenum. Naphthalene, Coal-tar Camphor, Moth-balls,* $C_{10}H_8$, U.S.P. 1890–1910.—Obtained from coal-tar and purified by crystallization, being formed by the union of 2 benzene groups, so as to have 2 carbon atoms in common; when coal-tar is distilled between 180–250° C. (356–482° F.) and the distillate has deposited gradually a dark crystalline substance, chiefly impure naphthalene, it is treated successively with NaOH and H_2SO_4 (to remove acid and basic by-products—phenols, aniline, etc.), then purified by distillation in the presence of steam, further heating with H_2SO_4 and distilling. It is in colorless, shining, transparent laminæ, strong characteristic odor of coal-tar, burning, aromatic taste, slowly volatilized and brownish by exposure, insoluble in water, soluble in alcohol (13), freely in ether,

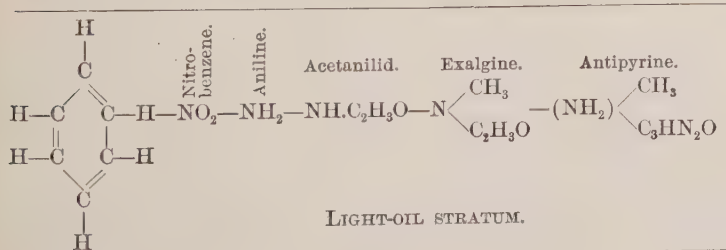
chloroform, carbon disulphide, fixed and volatile oils. *Test:* 1. On shaking with sulphuric acid should remain colorless, and if heated 5 minutes should not acquire more than a pale reddish tint (abs. of impurities derived from coal-tar). Antiseptic, expectorant, parasiticide, vermifuge; intestinal catarrh, inflammation, typhoid fever, diarrhea, whooping-cough, chronic bronchitis, bronchorrhea, wounds, ulcers, scabies, dysentery, prurigo. Dissolved in alcohol and used like spirit of camphor, for sprains, contusions. Should be kept in well-stoppered, amber-colored bottles. Dose, gr. 2–15 (.13–1 Gm.).

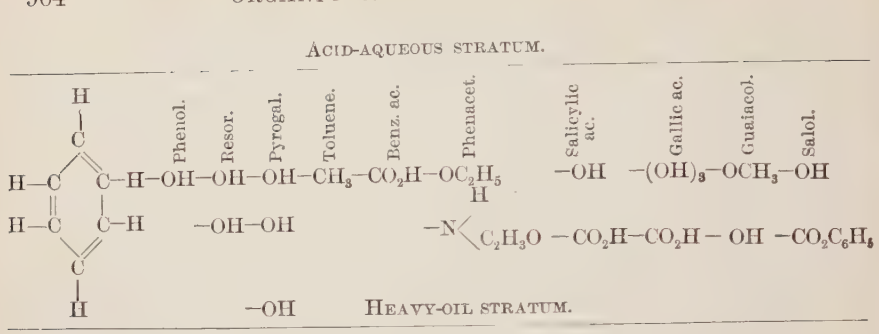
6. Benzene Derivatives Containing Nitrogen.

By analysis the exact molecular composition of many vegetable alkaloids has been determined, and inasmuch as many of these are troublesome to extract, hence expensive to the consumer, experimenters have interested themselves in trying to reproduce artificially such substances by joining their elements synthetically in the proper proportions. While this has often been found impracticable, yet the building, substitution, and replacement of elements with such an end in view have been remarkably successful. The greatest satisfaction has resulted from starting with basal products which contain the necessary elements in a condition or form susceptible of ready displacement. The cheapest and most acceptable base so far discovered is coal-tar, of which mention has been made in several connections. In experimenting with coal-tar, myriads of approximate principles or alkaloids have been formed, many of which, although not having the exact formulæ, are identical in most respects with its vegetable prototype. Beginning with coal-tar—in the first place it is distilled to obtain benzene, which is converted by nitric acid into nitrobenzene, and into this nascent hydrogen is liberated, producing aniline or phenylamine, $C_6H_5NH_2$:

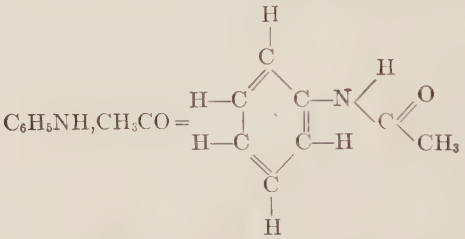
(1) $C_6H_6+HNO_3 + C_6H_5NO_2 + H_2O$. (2) $C_6H_5NO_2 + 6H = C_6H_5NH_2 + 2H_2O$.

Aniline (Ar. *anil*, indigo—*i. e.*, its brilliant violet and indigo dyes) is therefore the assumed basal product, which is a colorless, oily, alkaline liquid, peculiar aromatic odor, bitter taste, boiling at 181° C. (359° F.), insoluble in water, poisonous; it is an amine acting like a base, hence combines with acids, forming well-defined salts.





Acetanilidum. Acetanilid, *U.S.P.*—(Fr. *acet*(ic) + *anil*(ine) + *id*(e)—*i. e.*, referring to its components.) (Syn., Acetanil., Acetanilide, Antifebrin(um), Phenylacetamide, Antifebrinum, Antifebrin, Acetylamidobenzene; Fr. Acétanilide; Ger. Azetanilid, Antifebrin.)



Manufacture: This monoacetyl derivative of aniline is obtained from the latter by replacing its hydrogen by the acetic radical—acetyl, C_2H_3O—by boiling together aniline and glacial acetic acid for 1–2 days; now distil, collect portion passing over at 295° C. (563° F.), and when cool acetanilid congeals—$C_6H_5NH_2 + HC_2H_3O_2 = C_6H_5NHC_2H_3O + H_2O$; purify by repeated crystallization from water. It is in colorless, shining, crystalline leaflets or crystalline powder; odorless; permanent, melts at 114° C. (237° F.); soluble in water (190), boiling water (20), alcohol (3.4), boiling alcohol (.6), chloroform (3.7), ether (17), benzene (47), glycerin (5), acetone (4), slightly in petroleum benzin; aqueous solution neutral. *Tests:* 1. Boil .1 Gm. with sodium hydroxide T. S. (5)—characteristic aniline odor, + chloroform (1), heat—disagreeable odor of poisonous phenylisocyanide. 2. Boil .1 Gm. with hydrochloric acid (2)—clear solution, + aqueous solution of phenol, 1 in 20, (3), + filtered, saturated solution of chlorinated lime (5)—brownish-red, turning deep blue with ammonia water. 3. Saturated aqueous solution + bromine T. S.—white crystalline precipitate; ash .05 p. c. *Impurities:* Aniline salts, readily carbonizable substances. Dose, antipyretic, gr. 5 (.3 Gm.), anodyne, gr. 1–2 (.06–.13 Gm.), in pill, tablet, capsule, or in alcohol, then diluted in water; may repeat every 4 hours.

Preparation.—1. *Pulvis Acetanilidi Compositus, N.F.*, acetanilid 70 Gm., caffeine 10, sodium bicarbonate 20. Dose, gr. 5–10 (.3–.6 Gm.).

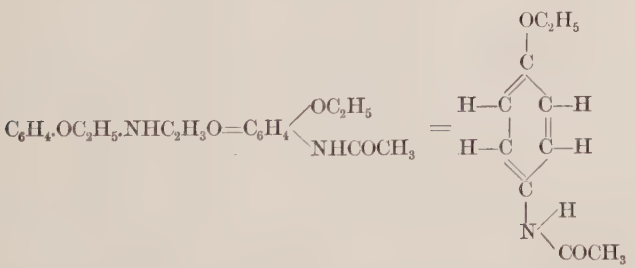
PROPERTIES.—Antipyretic, analgesic, antispasmodic, diuretic (increases excretion of urea and uric acid), diaphoretic, antiseptic. Small doses cause quietness; if large have headache, weakness, ringing in ears, a peculiar cyanosis, somnolence, mydriasis, lower temperature, slow respiration, feeble, irregular pulse, vomiting, profuse sweat, coma, collapse, general paralysis, dark urine, oxygen-carrying power of the blood is diminished, and corpuscles may be destroyed; blue color due to reduction of hemoglobin to methemoglobin in the blood. In the system acetanilid breaks up into acetic acid and aniline, and this latter oxidizes into paramidophenol—to which virtues are due. Action is chiefly on heart, liver, and kidneys, causing fatty degeneration; continued use is highly injurious.

USES.—Phthisis, typhoid fever, hyperpyrexia, sthenic fevers, gastralgia, locomotor ataxia, rheumatism, sciatica, lumbago, neuralgia, neuritis, gangrene, cancer, headache, insomnia, epilepsy, whooping-cough. There are many proprietary preparations containing 50–90 p. c. of acetanilid with sodium bicarbonate, ammonium or sodium bromide, salicylic acid, etc.

Poisoning: Have sweating, depression, slow breathing, irregular pulse, collapse, vomiting, cyanosis, prostration, death. Empty stomach, place in recumbent position, loosen clothing, plenty fresh air (for cyanosis), give diffusible stimulants (brandy, whisky, alcohol, ammonia, ether injections), coffee, atropine, strychnine (hypodermic), heat to feet and body, oxygen inhalations, rub skin, castor oil.

Incompatibles: Potassium and sodium hydroxides, chloroform.

Acetphenetidinum. Acetphenetidin, *U.S.P.*—(Syn., Acetphen., Phenacetin, Para-acetphenetidin, Para-ethoxyacetanilide; Fr. Amido-acetique de-l'amido-phénetol; Ger. Phenacetinum, Phenazetin.)



Manufacture: This monoacetyl derivative of para-amidophenetol is obtained by acting on phenol with diluted nitric acid, producing ortho- and para-nitrophenol—$C_6H_5OH + HNO_3 = C_6H_4(NO_2)OH + H_2O$; as para-nitrophenol is non-volatile, the two are separated by distillation with steam, the residuary para- being decolorized, crystallized and treated with sodium hydroxide, forming sodium nitrophenol, $C_6H_4(NO_2)ONa$, which, by heating with ethyl iodide,

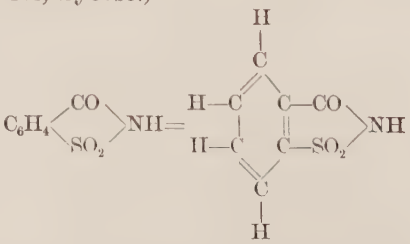
is converted into para-nitrophenetol—$C_6H_4(NO_2)ONa + C_2H_5I = C_6H_4(NO_2)OC_2H_5 + NaI$—which, by the action of nascent hydrogen, is converted into paraphenetidin—$C_6H_4(NO_2)OC_2H_5 + H_6 = C_6H_4(NH_2)OC_2H_5 + 2H_2O$, which, by prolonged boiling with glacial acetic acid, becomes para-acetphenetidin, similar to the conversion of aniline into acetanilid. It is in white, glistening, crystalline scales or fine white, crystalline powder; odorless; slightly bitter taste, faintly numbing the tongue; permanent, melts at 135° C. (275° F.); soluble in water (1310), boiling water (82), alcohol (15), boiling alcohol (2.8), chloroform (14), ether (130); aqueous solution neutral. *Tests:* 1. Boil .1 Gm. with hydrochloric acid (1), + distilled water (10), cool, filter, + a drop of potassium dichromate T. S.—ruby-red; ash .05 p. c. *Impurities:* Acetanilid, paraphenetidin, readily carbonizable substances. Dose, gr. 3–10 (.2–.6 Gm.).

Properties and Uses.—Antipyretic, analgesic, cardiac depressant, diuretic, safer than antipyrine or acetanilid—owing to its slower conversion into phenylamine; neuralgia, sciatica, locomotor ataxia, migraine, headache, hysteria, asthma, whooping-cough, epilepsy, rheumatism, chronic myelitis, arthritis, cystitis, metritis, acute neuritis, pleurisy, dysmenorrhea, sthenic (acute) fevers. For any paroxysm of headache, etc., give gr. 3 (.2 Gm.) every hour until 3 or 4 doses are taken; it is decomposed in the system into phenetidin and amidophenol, and is eliminated chiefly by the kidneys.

Poisoning: Excessive quantity may produce vomiting, sweating, cyanosis, feeble and rapid pulse, collapse; treat as for acetanilid, with alcoholic stimulants, strychnine hypodermically, warmth externally, etc.

Methyl Phenacetin, $C_6H_4OC_2H_5CH_3C_2H_3O$, and *Ethyl Phenacetin*, $C_6H_4OC_2H_5C_2H_5C_2H_3O$, are also hypnotics, the first being the stronger.

Glusidum. Gluside, *U.S.P.*—(Syn., Glusid., Benzosulphinidum, Benzosulphinide, Benzo-sulphinid., Saccharin, Neosaccharin, Glucusimide, Anhydro-orthosulphamidebenzoic Acid; Fr. Acide Anhydro-Orthosulfamide-Benzoique; Ger. Benzoesäuresulfinid, Zuckerin, Toluolsüss, Saccharol, Sycose.)



Manufacture: This anhydride of ortho-sulphamide-benzoic acid (benzoyl sulphonicimide) is prepared by a process involving six different steps: Take $C_6H_5CH_3$ (toluene) + H_2SO_4 + 100° C. (212° F.)

= $C_6H_4(CH_3)SO_3H$ (ortho- and para-toluenesulphonic acids), which are converted into calcium and then sodium salts by sodium carbonate; act upon these with phosphorus pentachloride = ortho- and para-toluenesulphochlorides, $C_6H_4(CH_3)SO_2Cl$, cool, when para- crystallizes out; to ortho- add ammonia gas = ortho-toluenesulphamide, $C_6H_4(CH_3)SO_2NH_2$, which is oxidized with potassium permanganate = potassium ortho-sulphamidebenzoate, and this freed from precipitated manganese dioxide and decomposed by an acid splits up into its aldehyde and water, instead of separating as free ortho-sulphamidebenzoic acid. It is in white crystals, white crystalline powder, odorless or faintly aromatic, taste intensely sweet in dilute solution (300–500 times sweeter than sucrose), soluble in water (290), boiling water (25), alcohol (31), ammonia water, alkali hydroxide solutions, alkali bicarbonate solutions with evolution of carbon dioxide, slightly soluble in chloroform, ether; saturated aqueous solution—acid; melts at 220° C. (432° F.)—pure gluside—228° C. (442° F.). *Tests:* 1. Dissolve .1 Gm. in aqueous solution of sodium hydroxide (1 in 10) 5 cc., evaporate to dryness, gently fuse—ammonia vapors evolved; after these cease dissolve residue in distilled water (20), neutralize with diluted hydrochloric acid, filtrate + a drop of ferric chloride T. S.—violet; ash .5 p. c. 2. Mix .02 Gm. with resorcinol .04, add 10 drops sulphuric acid, heat until dark green, cool, add dist. water 10 cc. + excess of sodium hydroxide T. S.—fluorescent-green. *Impurities:* Glucose, lactose, ammonium compounds, benzoic or salicylic acid, readily carbonizable substances. Dose, gr. $\frac{1}{4}$–2 (.015–.13 Gm.).

Preparations.—1. *Glusidum Solubile.* Soluble Gluside, $C_6H_4.CO.SO_2.NNa.2H_2O$. (Syn., Glusid. Sol., Sodii Benzosulphinidum, Soluble Saccharin; Fr. Sulphinide benzoique de soude; Ger. Saccharin solubile, Lösliches Saccharin, o-Benzoesäuresulfinidnatrum.)

Manufacture: Carefully neutralize solution of sodium carbonate (bicarbonate) with gluside, concentrate, crystallize. It is in colorless crystals, white, crystalline powder, odorless, faint aromatic odor, intense sweet taste, even in dilute solutions, 300–500 times sweeter than sucrose; somewhat efflorescent; soluble in water (1.2), alcohol (50). *Tests:* 1. Aqueous solution (1 in 10) 10 cc., + hydrochloric acid 1 cc. —crystalline precipitate (gluside). 2. Aqueous solution (1 in 10)—neutral, slightly alkaline, not red with phenolphthalein T. S., incinerate —residue chiefly sodium sulphate, giving yellowish flame. Dose, gr. $\frac{1}{4}$–2 (.015–.13 Gm.). 2. *Fluidextractum Cascaræ Sagradæ Aromaticum,* $\frac{1}{10}$ p. c. 3. *Elixir Terpini Hydratis et Creosoti Compositum, N.F.,* $\frac{1}{50}$ p. c. 4. *Lavatio Ori, N.F.,* $\frac{1}{5}$ p. c. 5. *Oleum Ricini Aromaticum, N.F.,* $\frac{1}{20}$ p. c. 6. *Tabellæ Phenolphthaleini, N.F.,* gr. $\frac{1}{50}$. 7. *Tabellæ Santonini, N.F.,* gr. $\frac{1}{100}$. 8. *Tabellæ Santonini Compositæ, N.F.,* gr. $\frac{1}{100}$.

Properties and Uses.—Sweetening agent, substitute for sugar when this is contraindicated: in diabetic or gouty patients, obesity; antiseptic; slight irritant to stomach when more than 5 gr. (.3 Gm.) given daily for a long time. Almost without physiological action—gr. 75

having produced no sensible effect on a man, as did gr. 600, in 10 days, on a dog, no change in weight, health, metabolism; employed in canned foods, preserves, beverages, etc.; retards action of enzymes, hence should be used with caution where digestion is impaired, Used in the proportion 1 in 10,000—$\frac{1}{2}\frac{1}{0}$ gr. per ounce; $\frac{1}{2}$ gr. equals a lump of sugar, and 1 gr. usually sweetens a cup of coffee. Soluble gluside is preferable owing to its more ready solubility.

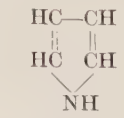
Cinchophenum. Cinchophen, $C_6H_5.C_9H_5N.COOH$, *U.S.P.* — (Syn., Cinchophen., Acidum Phenylcinchoninicum, U.S.P. 1910, Phenylquinoline-carboxylic Acid, Atophan, Phenylcinchoninic Acid, Acid Phenylcinch., Ger. Acidum phenylchinolincarbonicum, Phenylchinolinkarbonsäure.)

Manufacture: Heat for 3 hours on water-bath pyroracemic acid (1) and benzaldehyde (1), dissolved in alcohol, with aniline (1) previously dissolved in alcohol. It is in small, colorless, needle-like crystals, white to yellowish-white powder, odorless, slightly bitter taste, permanent; soluble in chloroform (400), ether (100), alcohol (120), more readily in hot than cold, almost insoluble in cold water; melts at 210° C. (410° F.) with partial decomposition; ash negligible; contains 99 p. c. pure acid. *Tests:* 1. Saturated solution in hot diluted hydrochloric acid, + platinic chloride T. S.—precipitate, yellowish-brown crystals. 2. Dissolve 1 Gm. in excess of ammonia T. S., evaporate to dryness, add distilled water 20 cc., filtrate (*a*) + silver nitrate T. S.—white flocculent precipitate, (*b*) + lead acetate T. S.—yellowish flocculent precipitate, (*c*) + copper sulphate T. S.—green flocculent precipitate. *Impurities:* Readily carbonizable substances. Should be kept dark, in well-closed containers. Dose, gr. 5–20 (.3–1.3 Gm.), 4 times daily, preferably in alkaline water.

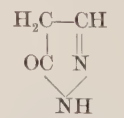
Properties and Uses.—Antirheumatic, antiseptic, analgesic, diuretic; gouty and rheumatic pains in joints or muscle sheaths, gouty and rheumatic neuralgia with fever, neuritis, elimination of uric acid, lithemic diathesis.

VI. Organic Bases.

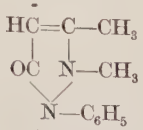
Antipyrina. Antipyrine, $C_{11}H_{12}ON_2$, *U.S.P.*—(Syn., Antipyr., Phenazone, Phenyldimethyl pyrazone, Methozine, Analgesine, Dimethylphenyl-isopyrazolone, Dehydrodimethylphenylpyrazine; Br. Phenazonum, Phenazone; Fr. Analgésine, Anodynine, Parodyne; Ger. Phenyldimethylpyrazol-onum,- on, Pyrazolonum phenyldimethylicum, Antipyrin.)



Pyrole



Pyrazolon



Antipyrine

Manufacture: This phenyldimethylpyrazolon, obtained by the condensation of phenylhydrazine with aceto-acetic ether and methylation

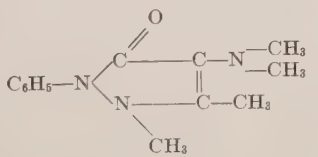
of the product, involves several steps—aniline chloride or sulphate is treated with sodium nitrite, the resulting diazobenzene chloride or sulphate is treated with reducing agents (alkali sulphite and stannous chloride), forming phenylhydrazine, $C_6H_5HN.NH_2$, which is heated with aceto-acetic ether, $CH_3CO.CH_2CO.OC_2H_5$, producing phenyl-methyl-isopyrazolone, $C_6H_5N.CO.CH:C(CH_3).NH$; dissolve this in methyl alcohol, heat with methyl iodide, forming a compound which treated with sodium hydroxide solution splits off hydriodic acid and separates antipyrine, as a heavy oil, that may be crystallized from toluene or ether. It is a white, almost odorless, crystalline powder, crystals, slightly bitter taste, soluble in water (1), alcohol (1.3), chloroform (1), ether (43); melts at 112° C. (234° F.); aqueous solution (1 in 20) neutral, colorless, *Tests:* 1. Aqueous solution + tannic acid T. S.—abundant white precipitate. 2. Aqueous solution (1 in 100) 12 cc. + sodium nitrite .1 Gm., + diluted sulphuric acid 1 cc.—deep green (isonitroso-antipyrine). 3. Aqueous solution (1 in 1000) 2 cc. + a drop of ferric chloride T. S.—deep red, changing to light yellow with 10 drops of sulphuric acid; ash .1 p. c. *Impurities:* Heavy metals, etc. Dose, gr. 2–20 (.13–1.3 Gm.).

Properties and Uses.—Antiseptic, anodyne, antipyretic, cardiac depressant, hemostatic, diuretic, antineuralgic, analgesic, contracts the bloodvessels—local anesthetic; migraine, locomotor ataxia, rheumatism, neuritis, urticaria, chorea, gout (arthritis), whooping-cough, tetanus, epilepsy, spasmodic laryngitis, sciatica, labor pains, diabetes, gravel, dysmenorrhea, headache, angina pectoris, cancer, syphilitic pains, biliary and renal colic, skin diseases, eye affections, locally to ulcers and as a hemostatic; too depressing for treating routine fevers. Antipyrine resembles acetanilid very closely, only is absorbed much more rapidly, and owing to its larger dose should be handled with even more caution, as it may produce tetanic and epileptiform convulsions (without suspending consciousness) and death by respiratory paralysis.

Poisoning: Similar to acetanilid.

Incompatibles: Iron chloride, iodide, and sulphate, copper sulphate, iodine, arsenic iodide, sodium bicarbonate, phenol (carbolic acid), hydrocyanic acid, nitric acid, nitrites, potassium permanganate, salicylates, calomel, corrosive sublimate, spirit of ethyl nitrite. All tannin preparations give white precipitate, and chloral hydrate decomposes it.

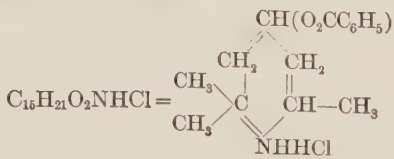
Amidopyrina. Amidopyrine, $(C_3ON_3(CH_3)_4.C_6H_5)$, *U.S.P.* — (Syn., Amidopyrin., Dimethylamino-antipyrine, Pyramidon-um; Fr. Diméthylamine-antipyrine; Ger. Dimethylamino-phenyldimethylpyrazolonum,-on, Pyrazolonum dimethylaminophenyldimethylicum, Pyramidon.)



Manufacture: A derivative of antipyrine in which an hydrogen atom of the pyrazolon group is replaced by the dimethylamino group, $N(CH_3)_2$, effected by reducing an acetic acid solution of nitrosoantipyrine in alcohol to amido-antipyrine, treating this latter with methyl chloride or iodide. It is in colorless, white, small crystals, white crystalline powder, odorless, nearly tasteless, permanent; soluble in water (18), alcohol (1.5), benzene (12), chloroform (1), ether (13); melts at 108° C. (226° F.); aqueous solution (1 in 25) slightly alkaline; ash .1 p. c. *Tests:* 1. Aqueous solution (1 in 25) 5 cc. + 3 drops diluted hydrochloric acid + 1 cc. ferric chloride T. S.—bluish-violet, + few cc. diluted sulphuric acid—changed to violet-red. 2. Aqueous solution 5 cc., + 5 drops silver nitrate T. S.—intense violet, same with other oxidizing substances; on standing—grayish-black precipitate (metallic silver) deposits. *Impurities:* Antipyrine, heavy metals, chloride, readily carbonizable substances.

Properties and Uses.—Antipyretic, anodyne, similar to antipyrine, but effect upon nervous system more powerful and lasting, can be given in smaller doses, thereby rendering action slower; said to be harmless to blood, kidneys and heart, although the latter's action is stimulated. Chronic fevers of tuberculosis, acute febrile conditions in typhoid, erysipelas, pneumonia; migraine, neuralgia, dysmenorrhea, asthma, rheumatism, headache. Dose, gr. 5–8 (.3–.5 Gm.), tablets—a single dose usually sufficing for 24 hours.

Eucainæ Hydrochloridum. Eucaine Hydrochloride, $C_5H_7N(CH_3)_3O(C_6H_5CO).HCl$, *U.S.P.*—(Syn., Eucain. Hydrochl., Betaeucainæ Hydrochloridum, U.S.P. 1910, Betaeucaine Hydrochloride, Betaeucain. Hydrochl., Eucaine Chloride, Eucaine; Fr. Chlorhydrate de Betaeucaine; Ger. Eucain B, Trimethylbenzoxypiperidinhydrochlorid.)



Manufacture: This synthetic derivative of piperidine is made by treating diacetonamine with paraldehyde, reducing product with metallic sodium to vinyldiacetonalkamine, benzoylating the latter with benzoyl chloride, dissolving resulting free base, benzoylvinyldiacetonalkamine, neutralizing with hydrochloric acid, crystallizing. It is a white crystalline powder, odorless, permanent, soluble in water (30), alcohol (35), chloroform (6), more soluble in boiling water or alcohol; saturated aqueous solution neutral, + silver nitrate T. S.—white precipitate, insoluble in nitric acid; contains 99 p. c. of pure salt. *Tests:* 1. Dissolve .1 Gm. in sulphuric acid 1 cc., keep at 100° C. (212° F.) 5 minutes, mix cautiously with water 2 cc.—aromatic odor

of methyl benzoate, on cooling—crystals of benzoic acid. 2. Saturated aqueous solution 10 cc. + few drops of mercuric chloride T. S.—white curdy precipitate, or + few drops of a mixture of equal volumes of potassium chromate T. S. and diluted sulphuric acid—yellow curdy precipitate; incinerate .5 Gm.—ash negligible. 3. Triturate, .05 Gm. with 5 times its weight of calomel, moisten with a few drops of water—no black color (dif. from cocaine hydrochloride). *Impurities:* Cocaine, alphaeucaine, readily carbonizable substances.

PROPERTIES AND USES.—Local anesthetic; closely related to cocaine and tropacocaine. Has the advantage of cocaine in being non-habit forming, less poisonous when absorbed, in not producing the primary ischemia followed by hyperemia, in affecting much less the heart circulation and respiration, in not drying the corneal epithelium, nor causing mydriasis or disturbed accommodation; solutions may be sterilized by boiling water without decomposition, and are stable (dif. from cocaine); largely employed in ophthalmology, 2–5 p. c. solution; for mucous surfaces, 2–5 p. c. Dose, hypodermically, ♏xv–60 (1–4 cc.) of 5 p. c. solution; may use ointment (1 p. c. + olive oil 2, wool fat 7). *Betaeucaine Lactate, Benzaminæ Lactas,* $C_{15}H_{21}NO_2.C_3H_6O_3$ (Br.).—Obtained by neutralizing benzoyl-vinyldiaceton-alkamine with lactic acid, crystallizing, or evaporating to dryness; superior to above from its greater solubility.

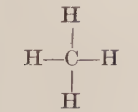
PART V.

NON-PHARMACOPŒIAL ORGANIC CARBON COMPOUNDS.

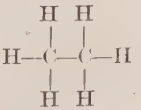
(Synthetic Remedies.)

It should be borne in mind, as incidentally referred to on page 841, that the possibilities which the constructive processes of organic chemistry open to us are almost beyond limit. Not a few of those products which we have solely heretofore, and do mostly even now, depend upon crude vegetable drugs for their origin, are at the present time being built up synthetically to such perfection as often to challenge recognition of distinctive sources. Of these, the *Pharmacopœia* would recognize more than it does were it not for partial secrecy in working formula and manufacture. Quite a number are employed so universally that the present day text-book excluding them might be considered more or less incomplete. In order that the chemical relationship may be better understood they have been treated, so far as practicable, in the same ordered sequence as adopted in Part IV. Before taking them up individually, it may be well to show, by graphic formulas, the facility with which the construction and substitution of one atom or a group of atoms for others may be effected—a process which invariably results in giving each time a different substance. In order to do this, and to carry along direct relationship, some of the compounds previously treated will have to be introduced at the sacrifice of repetition, but this may be considered not in the least a disadvantage to the student.

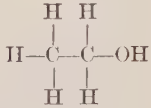
The majority of these synthetics which contain sulphur are hypnotics or sleep-producers, while those containing nitrogen are antipyretics or anodynes.



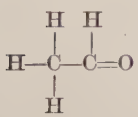
Methane=CH_4



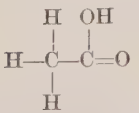
Ethane=C_2H_6



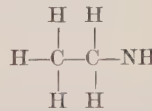
Ethyl Alcohol=C_2H_5OH



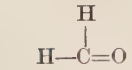
Aldehyde=C_2H_4O



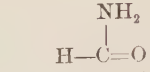
Acetic Acid=$C_2H_4O_2$



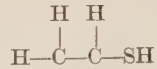
Ethylamine=$C_2H_5NH_2$



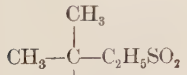
Formaldehyde=CH_2O



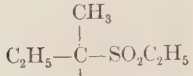
Formamide=$CHO.NH_2$



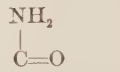
Mercaptan=C_2H_5SH



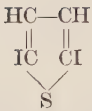
Sulphonal=$C_7H_{16}S_2O_4$



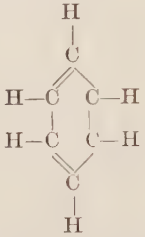
Trional =$C_8H_{18}O_4S_2$



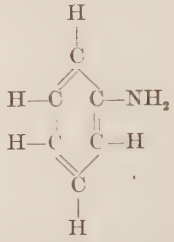
Urethane=$C_3H_7NO_2$



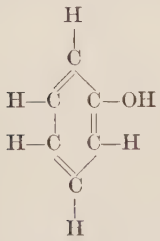
Thiophene-di-iodide=$C_4H_2I_2S$



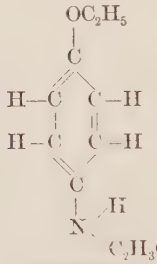
Benzene (Benzol)=C_6H_6



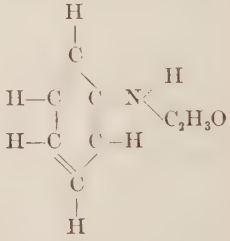
Aniline=$C_6H_5NH_2$



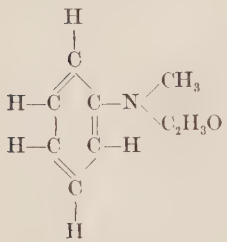
Phenol (Carbolic Acid)=
C_6H_5OH



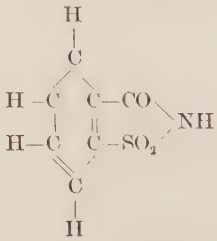
Phenacetin =$C_{10}H_{13}NO_2$



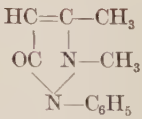
Acetanilid=C_8H_9NO



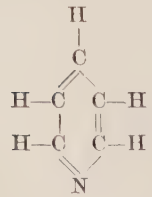
Exalgine=$C_9H_{11}NO$



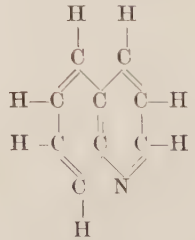
Gluside=$C_7H_5NO_3S$



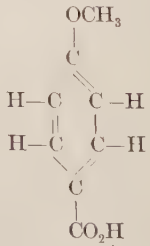
Antipyrine=$C_{11}H_{12}N_2O$



Pyridine=C_5H_5N

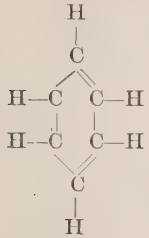


Chinoline=C_9H_7N



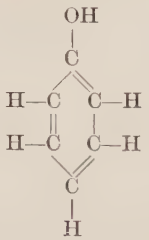
Anisic Acid=$C_8H_8O_3$

Hydrocarbons.



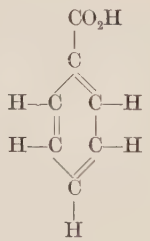
Benzene C_6H_6

Alcohols.

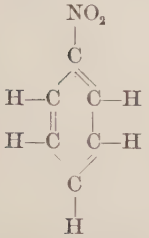


Phenol or Carbolic Acid= C_6H_5OH

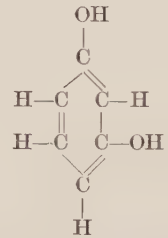
Acids.



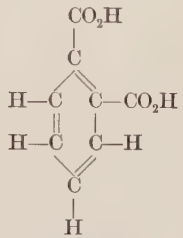
Benzoic Acid=$C_6H_5.CO_2H$



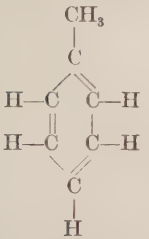
Nitro-benzene $-C_6H_5NO_2$



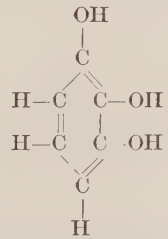
Resorcinol=$C_6H_4(OH)_2$



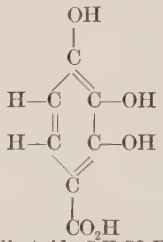
Phtalic Acid=$C_6H_4(CO_2H)_2$



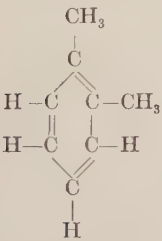
Toluene, Methyl-benzene= $C_6H_5.CH_3$



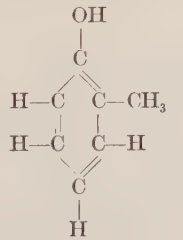
Pyrogallol $-C_6H_3(OH)_3$



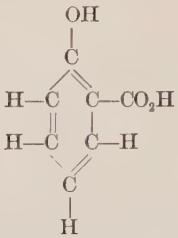
Gallic Acid=$C_6H_2CO_2H.(OH)_3$



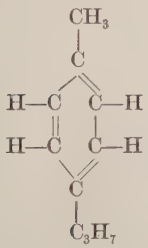
Xylene, Dimethyl-benzene= $C_6H_4(CH_3)_2$



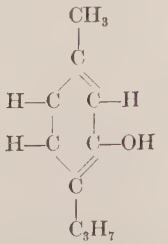
Cresol=$C_6H_4.CH_3.OH$



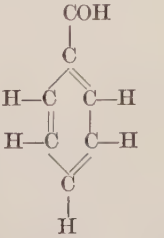
Salicylic Acid=$C_6H_4.CO_2H.OH$



Cymene, Methyl-propyl-benzene=$C_6H_4.CH_3.C_3H_7$



Thymol=$C_6H_3CH_3.C_3H_7OH$



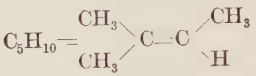
Benzaldehyde, Oil of Bitter Almond=$C_6H_5.COH$

I. FATTY SERIES (PARAFFIN OR METHANE).

(Open-chain Compounds.)

I. Hydrocarbons.

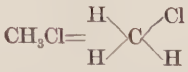
Pental. Pentalum.—Amylene, Beta-iso-amylene, Tri-methyl-ethylene.



This, from the fifth member of the series, amylene, is obtained by digesting amyl hydride (hydroxide) or amylic alcohol with zinc chloride for 24 hours, or preferably the two are shaken occasionally together for some time with diluted sulphuric acid, thereby producing amyl sulphuric acid, which when diluted with water yields tertiary amyl alcohol and pure pental, the latter being separated by fractional distillation. It is a colorless liquid, very inflammable and volatile, not affected by light or air, mustard-like odor, insoluble in water, miscible in all proportions with alcohol, chloroform, and ether, sp. gr. 0.667, boils at 38° C. (100.4° F.). Anesthetic; when inhaled acts as rapidly and safely as nitrous oxide gas, and superior to it in having a longer action and no unpleasant after-effect; acts more promptly than chloroform (1–3 minutes); consciousness is not lost when the stage of pain-insensibility is reached; stage of exhilaration is seldom present; and drug does not lose effect by repetition; considered by some—dangerous cardiac depressant; used for minor surgical operations, tooth-extraction, etc., being administered like chloroform. Dose, ♏v–10 (.3–.6 cc.), internally, but for inhalation ʒij–4 (8–15 cc.).

1. Halogen Derivatives.

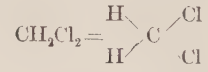
Methyl Chloride. Mono-chlor-methane.



Obtained by heating together under pressure in a steam digester methyl alcohol, hydrochloric acid (gas), and zinc chloride—$CH_3OH + HCl = CH_3Cl + H_2O$; the zinc chloride simply facilitates the process; the methyl chloride has now to be purified by washing with water, acid, and alkali. It is a colorless gas, burning with a green flame, having an ether and chloroform-like odor, 1 vol. water dissolves 4 vols., while 1 vol. methyl or ethyl alcohol dissolves 35 vols.; it is also freely soluble in ether and chloroform. When cooled to —23° C. (—11.4° F.), under normal pressure, becomes a liquid which boils at —21° C. (—5.8° F.); a pressure of 5 atmospheres at normal temperature also condenses it. Local anesthetic—does not produce complete

muscular relaxation. It is kept usually in pointed glass pearls; the point being broken off, the heat of the hand is sufficient to volatilize the contents, and thus force it out as a fine spray upon the desired location. Before applying, it is well to wash the skin with soap and water to remove all fat, and to hold spray-nozzle 10 inches from the spot to be frozen. The skin soon becomes white and parchment-like, when minor surgical operations, as opening abscesses, boils, etc., may be performed painlessly. The spray should not be continued longer than 2–4 minutes, as death of tissue may result.

Methylene Bi(di)chloride. Di-chlor-methane.



Obtained by passing chlorine into methyl chloride (CH_3Cl), or reduce chloroform ($CHCl_3$) with zinc and hydrochloric acid. It is a colorless liquid, chloroform-like odor, insoluble in water, soluble in alcohol or ether, sp. gr. 1,354, boils at 40° C. (104° F.). It should be kept in well-stoppered bottles, in the dark, to prevent decomposition, which may also be obviated by the addition of 1 p. c. alcohol. Dose, ♏x–30 (.6–2 cc.), but mostly inhaled. Anesthetic—by some considered unsafe; for minor operations use ʒj–2 (4–8 cc.), for major ones, should not employ more than ʒiij–6 (12–24 cc.).

Methylthionine Chloride. Methylthioninæ Chloridum, *U.S.P.*

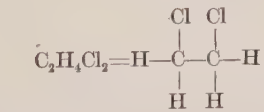
Methenyl Tri-chloride. Chloroformum. Chloroform, *U.S.P.*

Methenyl Tri-bromide. Bromoformum. Bromoform, *U.S.P.* 1900–1910.

Methenyl Tri-iodide. Iodoformum. Iodoform, *U.S.P.*

Ethyl Chloride. Æthylis Chloridum. Mono-chlor-ethane, *U.S.P.*

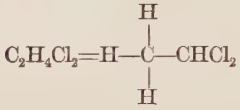
Ethylene Bi(di)chloride. Æthyleni Bichloridum.—Ethene Chloride, Dutch Liquid.



Obtained by combining equal volumes of the unsaturated hydrocarbon ethylene (C_2H_4) and chlorine (Cl_2). It is a colorless, thin, oily, volatile liquid, sweet taste, chloroform-like odor, sp. gr. 1.26, boils at 85° C. (185° F.), soluble in alcohol, ether, sparingly in water. Anes-

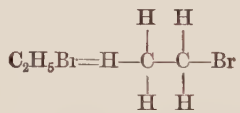
thetic. Much safer than chloroform (no collapse, although depresses heart, lowers arterial pressure), more pleasant and rapid in action, causes no excitement like ether, and recovery is quicker. It is, however, more expensive than chloroform, and irritates the throat so much that it is used with difficulty; efficacious locally in neuralgia.

Ethylidene Chloride. Di-chlor-ethane.—Mono-chlorinated Hydrochloric Ether.



This is isomeric with ethylene bichloride, which it resembles in odor; has a density of 1.198, boils at 57.5° C. (135.5° F.), and is decomposed by sulphuric acid; it is a colorless, hot, sweet, volatile liquid of chloroformic odor. Anesthetic for inhalation; lowers arterial pressure; acts similarly to chloroform—possibly a better preparation.

Ethyl Bromide. Æthylis Bromidum.—Mono-bromo-ethane, Ether Bromatus, Hydrobromic Ether.

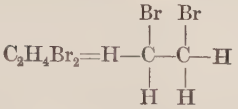


Obtained by distilling alcohol (12) and sulphuric acid (7), gradually adding potassium bromide (12):

(1) $C_2H_5OH+H_2SO_4=C_2H_5HSO_4+H_2O$.
(2) $C_2H_5HSO_4+KBr=C_2H_5Br+KHSO_4$.

It is a colorless, light, refractive, mobile, heavy liquid, very volatile, sweet warm taste, chloroform-like odor, sp. gr. 1.445–1.450, boils at 39° C. (102° F.), miscible with alcohol, chloroform, ether, and oils, but not with water. Should be kept in the dark and in well-stoppered flasks, inasmuch as air and light decompose it into hydrobromic acid and bromine. Anesthetic. It is rapid, transient, abolishing pain without loss of consciousness, depresses respiration, but is attended, as a rule, with no bad effects, as is chloroform. A few whiffs are generally sufficient to cause anesthesia, which lasts sufficiently long for all minor surgical operations, as opening abscesses, boils, in dentistry, etc. In administering, hold the towel close to the mouth to prevent admission of air, and put the full quantity thereupon at once, which should be ʒij–6 (8–24 cc.). With most anesthetics the converse is the case. Administer on empty stomach, only one minute, do not reapply, and never use when lesions of heart, kidneys, or lungs are present.

Ethylene Bromide. Æthylenum Bromatum.—Brom-ethylene.



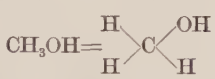
Obtained by passing the unsaturated hydrocarbon ethylene (C_2H_4) into bromine until saturation is effected—$C_2H_4 + Br_2 = C_2H_4Br_2$. It is a colorless, strongly refracting liquid, sweet taste, chloroformic odor, sp. gr. 2.170, boils at 132° C. (269° F.).

Used in epilepsy, delirium tremens nervous insomnia; should not be confounded with ethyl bromide, owing to its more poisonous properties. Dose, ♏ij–5 (.13–.3 cc.).

II. Alcohols.

2. Oxygen Derivatives.

Methyl Alcohol. Alcohol Methylicum.—(Syn., Methyl Hydroxide, Wood Alcohol (Spirit, Naphtha), Methanol, Pyroligneous Spirit (Alcohol); Fr. Alcool (Esprit) de Bois.)



The aqueous portion of the distillate from the destructive distillation of wood contains 1 p. c., along with acetic acid, acetone, aldehyde, allyl alcohol, oils, etc.; this lighter portion is saturated with chalk, $CaCO_3$ (forming calcium acetate), then distilled, and all that comes over under 100° C. (212° F.) is crude wood spirit, which has to be rectified again over $CaCl_2$ and CaO. It is a thin, colorless liquid, peculiar odor, burning taste, sp. gr. 0.802. A purified product, having less odor, under the name of *Columbian (Colonial) Spirit* is used largely in making external remedies and those from which it is reclaimed during manufacture. Poisonous; used mostly in the arts as a substitute for (ethyl) alcohol to dissolve resins, volatile oils, alkaloids, etc.

Methylated Spirit consists of ethyl alcohol 90 p. c. + methyl alcohol 10 p. c. This is used abroad as an alcoholic solvent, owing to its being free from internal revenue tax; very poisonous.

Ethyl Alcohol. Alcohol, C_2H_5OH, *U.S.P.*

Denatured Alcohol. Alcohol Denaturatum.—Ger. Denaturirter Spiritus.

Obtained 1. By mixing alcohol (180° proof) 100 gallons, methyl alcohol 10 gallons, benzin .5 gallon. 2. Mixing alcohol (180° proof) 100 gallons, methyl alcohol 2 gallons, pyridine bases .5 gallon. 3. Mixing ethyl alcohol (160° proof) 100 parts, wood alcohol (methanol) 4, aldehol ¾, benzin ½; aldehol is oxidized or burned kerosene, very

disagreeable nauseating taste, with the odor of automobile exhaust fumes (excess of oil consumption)—a good substitute for pyridine; emetic, not fatal. 4. Mixing alcohol 100 gallons, methyl alcohol 5 gallons, camphor 7 pounds. 5. Mixing alcohol 100 gallons, methyl alcohol 2 gallons, benzol (benzene) 2 gallons. It is a transparent, colorless, mobile, volatile liquid, characteristic burning taste, odor varying as to denaturants used. As thus made it is unfit for use in many industries, consequently the Internal Revenue Department has authorized other formulas (20) to serve special purposes, all, however, rendering the final product unsuitable for a beverage or an internal medicine, so as to be withdrawn from bond tax-free. All denaturants —methyl alcohol, benzene, pyridine bases, aldehol, camphor, lye, castor oil, diethylphthalate, quinine, brucine, tartar emetic, etc.— must conform to the Government specifications. Poisonous; only to be used externally as fuel, light, power, solvent in arts, etc.; shellac varnishes, photographic collodion and dry plates, lacquers from soluble cotton, resin podophyllum, acetic ether, ethyl chloride, embalming fluid, heliotropin, chewing and smoking tobacco, ether for anesthesia, sulphomethane, fulminate of mercury, photo-engravings, transparent soap, barometers, thermometers, watches, purification of rubber, imitation leather, etc.

Amylene Hydrate. Di-methyl-ethyl-carbinol.—Tertiary Amyl Alcohol.

$$C_5H_{12}O = \begin{matrix} CH_3 \\ CH_3 \end{matrix} \diagdown C \diagup \begin{matrix} C_2H_5 \\ OH \end{matrix}$$

Obtained by treating impure amylene with H_2SO_4, which forms amyl sulphuric acid; this is diluted, filtered, neutralized with milk of lime or solution of sodium hydroxide, and then fractionally distilled. It is a clear, oily liquid of a peculiar penetrating odor resembling that of a mixture of camphor and peppermint, burning taste, sp. gr. 0.815, boils at 102.5° C. (216.5° F.), dissolves in water (8), miscible in all proportions with alcohol, chloroform, ether, benzin, fixed oils, and glycerin, yields acetic acid on oxidation. Hypnotic, anodyne. Has a power midway between chloral hydrate and paraldehyde. Dose, ℥xv–45 (1–3 cc.) in wine, fruit, syrup, or water; if it disagrees with stomach—give hypodermically.

III. Aldehydes.

Solution of Formaldehyde. Liquor Formaldehydi, *U.S.P.*

Methenamine. Hexamethylenamine. Urotropine, *U.S.P.*

Tannoform. Methylene Ditannin, $(C_{14}H_9O_9)_2CH_2$.

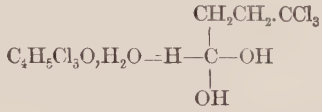
Obtained by dissolving tannin 5 Gm., in hot water 15 Kg., adding 30 p. c. formaldehyde 3 Kg., precipitating with hydrochloric acid 15

Kg., washing precipitate. There are several tannoforms, each differing only in the purified plant extract used containing the tannin. Tannoform is a light, pinkish-white powder, soluble in alcohol. Enteritis, diarrhea, bedsores, fetor of feet and sweat, chancres, eczema, pruritus vaginæ. Dose, gr. ½–1 (.03–.06 Gm.).

Paraldehyde. **Paraldehydum,** $C_6H_{12}O_3$, *U.S.P.*

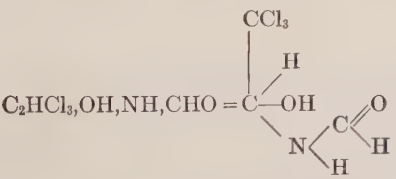
Chloral Hydrate. **Chloralis Hydras,** C_2HCl_3O,H_2O, *U.S.P.*

Butyl-Chloral Hydrate. **Butyl-Chloral Hydras.**—Chloral Butylicum, Croton-Chloral Hydrate (misnomer), Trichlorbutylaldehydehydrate.



Obtained by passing dry chlorine gas through (acetic) aldehyde, when butyl-chloral, $C_4H_5Cl_3O$, is formed, which being an oil is separated by fractional distillation; this then will unite with water to form a solid hydrate, and from this solution butyl-chloral hydrate crystallizes in white scales with a peculiar pungent, fruit-like odor, warm, bitter, nauseous taste; it is readily soluble in alcohol, ether, hot water, and glycerin, slightly in cold water, melts at 78° C. (172° F.). Hypnotic. Similar to chloral hydrate, but less certain, and by some claimed to be not so depressant to the heart. Good in facial neuralgia, migraine, tic douloureux, headache, nausea, neuralgia—due to decayed teeth. *Incompatibles:* All alkalies. Dose, gr. 5–30 (.3–2 Gm.), in pills, syrup. It is well to give gr. 3–5 (.2–.3 Gm.) every 2 hours until pain is relieved or sleep produced.

Chloralformamide. **Chloralformamidum.**—Chloralamide.



Obtained by direct union of anhydrous chloral (147) with formamide (45) at ordinary temperature, purifying resulting solid by crystallization from water or 30 p. c. alcohol. It is in shining, colorless, odorless, slightly bitter crystals, soluble in ether, glycerin, acetone, acetic ether, water (18.7), alcohol (1.3), hydrolized at 60° C. (140° F.) into components—chloral hydrate + formamide (ammonium formate), melts

at 115° C. (239° F.), decomposed at higher temperature, and by warming with alkali hydroxides with separation of chloroform, not affected by diluted acids. *Impurities:* Chloral alcoholate, ethyl carbamate, formic, hydrochloric and other free acids, decomposition products, inorganic substances; should be kept in well-stoppered, amber-colored bottles. Hypnotic; resembles chloral hydrate but without harmful after-effects; neither tolerance nor habit from long usage; does not relieve pain; painless insomnia, hysteria, asthma, rheumatism, spinal diseases, heart affections, chorea; owing to insolubility, absorption and effect are slow, consequently it should be dissolved in alcohol, brandy, or aromatic sulphuric acid. One of the best preventives of sea-sickness, when a cathartic just before, and gr. 30 (2 Gm.) each of this and potassium bromide on an empty stomach after going aboard ship, and a rest in bed usually affords comparative relief. Dose, gr. 10–40 (.6–2.6 Gm.).

Chloralose. Anhydro-gluco-chloral, $C_8H_{11}Cl_3O_6$.

Obtained by heating together equal quantities of anhydrous chloral and glucose at 100° C. (212° F.) for at least an hour, treating the cooled mass with a little water, boiling with ether, distilling the ether-soluble portion with water to remove chloral, crystallizing; yield about 3 p. c. It occurs in small colorless crystals, bitter, disagreeable taste, soluble in alcohol, ether, acetic acid, hot water, slightly in cold water; melts at 185° C. (365° F.). Hypnotic; free from cumulative and cardiac after-effects. Causes profound sleep, in which sensibility is not lost; owing to its great bitterness should be given in capsules or cachets. Its poisonous effect resembles very much that of chloral hydrate. Dose, gr. 5–15 (.3–1 Gm.).

Acetone. Acetonum, $(CH_3)_2CO$, *U.S.P.*

Acetozone. Benzoylacetyl Peroxide, $(C_6H_5CO.COCH_3)O_2$.

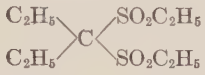
Obtained by oxidizing mixture of benzaldehyde and acetic anhydride. Occurs in white shining crystals, melting at 37° C. (98° F.), soluble in water (1:1000–10,000, according to temperature), oil (35), slightly in alcohol, ether, chloroform. Commercial acetozone contains equal weight of an inert absorbent, and even then, owing to irritating stomach, should only be given in solutions, which, except oily, gradually decompose, especially when heated or alkali added. Aqueous solution oxidizing agent, similar to hydrogen dioxide, antiseptic, germicide; diarrhea, dysentery, cholera, gonorrhea, edema, tinea, typhoid (lessening tympanites, diarrhea, odor, nervousness, temperature), tonsillitis, urethritis, abscesses, gangrene, corneal ulcers, etc. Dose, gr. 3–5 (.2–.3 Gm.); solution 1 in 1000, or gr. 15 (1 Gm.) dissolved in warm water, 4 pints (2000 cc.)—entire or half within 24 hours. *Inhalant* consists of acetozone (2), chloretone (1), liquid petrolatum 197.

3. Sulphur Derivatives.

Sulphonmethane. Sulphonmethanum. Sulphonal, *U.S.P.*

Sulphonethylmethane. Sulphonethylmethanum. Trional, *U.S.P.*

Tetronal. Tetronalum.—Diethyl-sulphon-diethyl-methane.



Obtained similar to sulphonal, except here begin with diethyl-ketone instead of acetone. It is in colorless, odorless, shining plates or laminæ, soluble in alcohol, ether, hot water, and cold water (450); melts at 89° C. (192° F.). Hypnotic. Similar to, but much less used than sulphonal and trional. Dose, gr. 15–30 (1–2 Gm.).

The three last compounds or sulphones depend upon the ethyl groups for hypnotic effects, the greater their number the more powerful the action.

IV. Acids.

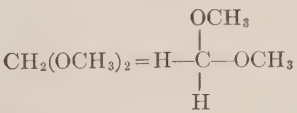
Acetic Acid.—Acidum Aceticum, $C_2H_4O_2$, *U.S.P.*

Trichloracetic Acid. Acidum Trichloraceticum, $HC_2Cl_3O_2$, *U.S.P.*

Lactic Acid. Acidum Lacticum, $C_3H_6O_3$, *U.S.P.*

V. Ethers.

Methylal.—Methylene-dimethyl Ester (Ether), Formal.



Obtained by distilling together methyl alcohol, sulphuric acid, and manganese dioxide, by which process the methyl alcohol is oxidized; potassium hydroxide may be added to the distillate to separate the methyl formate. This is a mobile, colorless, volatile liquid, odor like chloroform and acetic ether, burning, aromatic taste, soluble in alcohol, ether, oils, and water (3), sp. gr. 0.855, boils at 42° C. (107.6° F.). Anesthetic, hypnotic, narcotic; asthma, colic, angina, tetanus—safe, pleasant, but soon loses influence. Dose, ℥xxx–90 (2–6 cc.), in emulsion, or syrup and water.

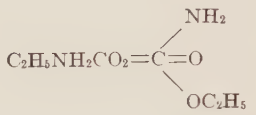
Ethyl Ether. Æther.—Ethyl Oxide, $(C_2H_5)_2O$, *U.S.P.*

Ethyl Nitrite. **Nitrous Ether,** $C_2H_5NO_2$, *U.S.P.*

Amyl Nitrite. **Amyl Nitris,** $C_5H_{11}NO_2$, *U.S.P.*

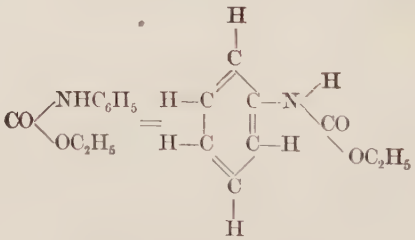
4. Urea Derivatives.

Ethyl Carbamate. **Æthylis Carbamas.** **Urethane,** $C_2H_5NH_2CO_2$.—



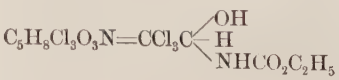
Obtained by heating together urea nitrate and ethyl alcohol for several hours in a steam digester at 120–130° C. (248–266° F.); the resulting crystalline mass is dissolved in water, shaken out with ether; after recovering ether, residue is distilled and crystallized from water. $(NH_2)_2COHNO_3 + C_2H_5OH = CONH_2.OC_2H_5 + NH_4NO_3$. It is in colorless columnar crystals, scales, odorless, cooling, saline taste, soluble in fixed oils, somewhat soluble in water, alcohol, chloroform, and ether; neutral. *Impurities:* Urea, chloride, nitrate. Should be kept in well-closed containers. Hypnotic, without unpleasant after-effects; resembles paraldehyde in action; overdoses depress spinal cord, heart, and respiration, death due to asphyxia; used in nervous or functional insomnia, or that due to mental or physical depression, chronic alcoholism, insanity; convulsions. Dose, gr. 10–40 (.6–2.6 Gm.).

Euphorin. **Æthylis Phenylcarbamas.** **Phenyl Urethane.**



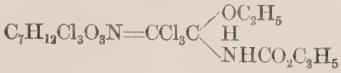
Obtained by the interaction of chlor-ethyl-formate and aniline. It is a white crystalline powder, faint aromatic odor, clove-like after-taste, soluble in alcohol, ether, hydro-alcoholic solutions. Antipyretic, analgesic, antirheumatic; as a substitute for iodoform. Dose, gr. 2–10 (.13–.6 Gm.).

Ural. **Uralium.**—Chloral Urethane, Uraline.



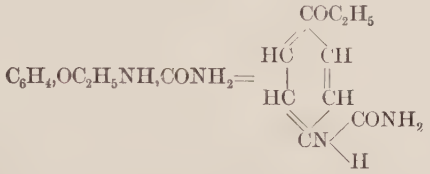
Obtained by mixing together chloral hydrate and urethane; on adding HCl they unite into a solid which is insoluble in cold water; treat with H_2SO_4, wash with water; decomposed by hot water into its two components, soluble in alcohol or ether. Hypnotic; cough, angina, insomnia. Dose, gr. 10–40 (.6–2.6 Gm.).

Somnal. **Ethylated Chloral Urethane.**



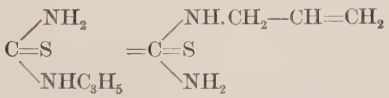
This is an alcoholic solution of ural, or a union of alcohol, chloral hydrate, and urethane. It is hypnotic in doses ♏x–40 (.6–2.6 cc.).

Sucrol. **Dulcin.**—Para-phenetol-carbamide, Para-ethoxy-phenyl Urea.



Obtained by acting on para-phenetidine with carbonyl chloride to form dipara-phenetol-carbamide, and heating this in steam digester with urea to 160° C. (320° F.); it crystallizes from water in shining needles; sweet taste, soluble in hot water (150), cold water (800), alcohol (25)—200 times sweeter than sugar, for which it is used in diabetes, but prohibited by most food laws.

Thiosinamin. **Allyl-thio-urea.**—Allyl-sulpho-urea.



Obtained by acting on allyl-sulphocyanate (mustard oil, C_3H_5NCS) with ammonia. Occurs in colorless, rhombic crystals, bitterish, soluble in water, alcohol, ether, melts at 74° C. (165° F.), garlic odor. Inject subcutaneously for lupus, tuberculous diseases; causes absorption of exudate, corneal opacities. Dose, gr. ½–7 (.03–.5 Gm.), by injection, repeated every 3–4 days. Poisonous.

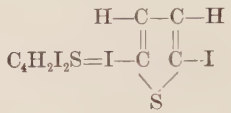
Barbital. **Barbitalum, Diethylmalonylurea, Veronal,** *U.S.P.*

Soluble Barbital. **Barbital Sodium,** *U.S.P.*

Phenobarbital,-um. **Phenylethylmalonylurea,** *U.S.P.*

5. Thiophene Derivatives = C_4H_4S.

Thiophene-Di-iodide.—Di-iodo-thiophene.



Obtained by the action of iodine on thiophene (C_4H_4S, a product from benzene) in the presence of mercuric oxide. It is in colorless, volatile crystals, aromatic odor, soluble in ether, chloroform, hot alcohol, insoluble in water; melts at 40.5° C. (104.9° F.); contains 75.5 p. c. iodine and 9.5 p. c. sulphur. Antiseptic. As a substitute for iodoform.

Sodium Thiophene-sulphonate, $C_4H_3S.SO_3Na$.—This is a white crystalline powder, containing 33 p. c. sulphur, with a feeble, disagreeable odor, and used like the preceding.

II. AROMATIC (BENZENE) SERIES, C_6H_6.

(Closed-chain Compounds.)

6. Terpenes.

Terebene. Terebenum, $C_{10}H_{16}$, *U.S.P.*

Terpin Hydrate. Terpini Hydras, $C_{10}H_{16}3H_2O$, *U.S.P.*

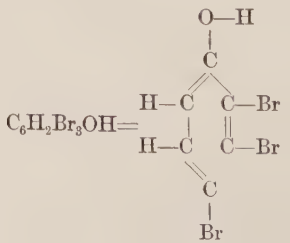
Phenol. Acidum Carbolicum, C_6H_5OH, *U.S.P.*

Menthol. Menthol, $C_{10}H_{20}O$, *U.S.P.*

Arsphenamine. Arsphenamina. Salvarsan, *U.S.P.*

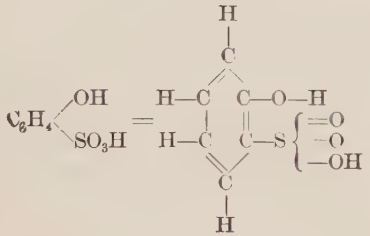
Neoarsphenamine. Neoarsphenamina. Neosalvarsan, *U.S.P.*

Bromol. Tri-bromo-phenol.—Tri-brom-phenol.



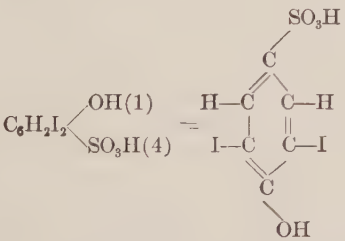
Obtained by acting on phenol with bromine—$C_6H_5OH + 6\ Br = C_6H_2Br_3OH + 3HBr$. It is a colorless crystalline powder, soluble in alcohol, chloroform, ether, fixed or volatile oils, insoluble in water; melts at 95° C. (203° F.); odor unpleasant, taste sweetish, astringent. Antiseptic, disinfectant, caustic; tuberculous ulcers, gangrene, diphtheria, cholera infantum. Dose, gr. 1–8 (.06–.5 Gm.); locally 3 p. c. solution in oil, also 12.5 p. c. ointment, or 3–10 p. c., + talcum—dusting-powder. Should not be confounded with *bromal*.

Aseptol. Ortho-phenol Sulphonic Acid.—Sozolic Acid, Sulpho-(carbol) phenol.



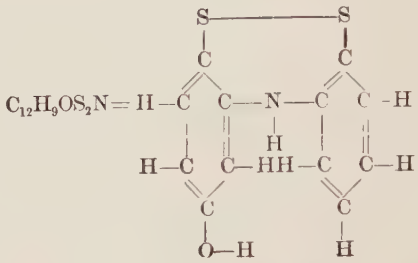
Obtained by mixing phenol and sulphuric acid at a very low temperature, allowing to stand several days, purifying this product by converting it into the barium salt and precipitating barium with H_2SO_4. It is a solution containing 33 p. c. ortho-phenol-sulphonic acid, having a sour taste, acid reaction, and phenol-like odor. Antiseptic; similar to phenol, but possesses only one-third of its antiseptic power.

Sozoiodol. Sozoiodolic Acid.—Di-iodo-para-phenyl-sulphonic acid.



Obtained by heating together phenol (2), sulphuric acid (1), for 3 days at 110° C. (230° F.), forming para-phenol-sulphonic acid, and treating this with iodine. The compound crystallizes from water in needle-shaped prisms which are soluble in alcohol or water; contains iodine 54 p. c., phenol 20 p. c., sulphur 7 p. c. Antiseptic in 2–10 p. c. solutions. The metallic salts which this acid forms are good substitutes for iodoform, those with sodium being preferred; eczema herpes, impetigo, otitis, rhinitis, scabies.

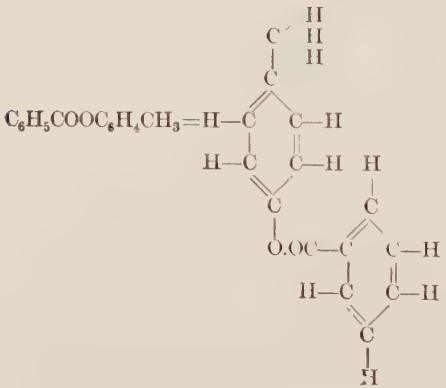
Sulphaminol. Thio-oxy-diphenylamine.



Obtained by boiling together meta-oxy-diphenylamine, sodium hydroxide solution, and sulphur, treating filtered solution with ammonium chloride. It occurs as a yellow, odorless, tasteless powder, soluble in alkalies, alcohol, glacial acetic acid; insoluble in water; melts at 155° C. (311° F.). Antiseptic. As a substitute for iodoform.

Cresol. Cresylic Acid, $C_6H_4(CH_3)OH$, *U.S.P.*

Benzo-para-cresol. Para-cresyl-benzoate.



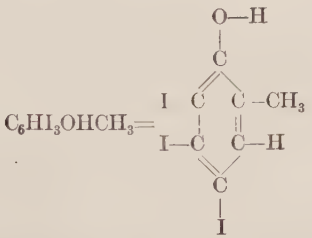
Obtained by the action of benzoylchloride on the sodium salt of para-cresol. It is in colorless needles, soluble in chloroform, ether, hot water, insoluble in water; melts at 71° C. (160° F.). Antiseptic. The preparations creolin, lysol, saprol, solutol, solveol, sozal, etc., are complex mixtures of the three cresols—ortho, meta, para.

Creolin. Creolinum.—Creolins are antiseptic and disinfectant soluble preparations (emulsions) of cresols, free from phenol, made soluble by means of rosin soap or sulphonation with sulphuric acid. Those with soap are usually reddish-black syrupy liquids, tarry odor, sp. gr. 1.040–1.070, forming clear solutions with alcohol, ether, chloroform,

benzin, benzene; the sulphonated creolins hold free cresols in solution, forming milky emulsions with water; sodium salicylate is also a good solvent of cresols. Antiseptic, sedative; it is powerful but non-irritating. Used as a substitute for phenol, anti-fermentative. Internally, for gastric fermentation, dysentery, and typhoid fever. Dose, ♏j–5 (.06–.3 cc.).

Lysol. Lysolum.—Made by reserving distillate from the coal-tar oil that comes over between 190–200° C. (374–392° F.), which is boiled in fat until dissolved, then saponified with alcohol (or alkali). It is a brown, oily-looking, clear liquid, aromatic odor, resembling creosote; contains 50 p. c. of cresol; it is soluble in water, forming clear, frothing, saponaceous liquid, also in alcohol, chloroform, or glycerin. Antiseptic in surgery, gynecology—poisonous. It is 5 times stronger, but only one-eighth as poisonous as phenol, and one-half as poisonous as creolin. Useful in skin diseases, lupus, diphtheria, gargle for foul breath. Should be applied in aqueous solution (1–3 p. c.).

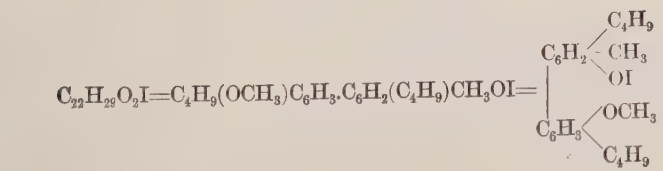
Losophan. Tri-iodo-meta-cresol.—



Obtained by adding aqueous solution of iodine and potassium iodide slowly, with stirring, to solution of ortho-oxyparatoluic acid in sodium bicarbonate and water; after 24 hours wash precipitate with water, crystallize from alcohol. It is in colorless, odorless needles, slightly acid, soluble in benzene, chloroform, ether, diluted NaOH, slightly in alcohol, insoluble in water, decomposed by strong caustic soda; melts at 122° C. (251° F.); contains iodine 78.39 p. c. Antiseptic; parasitic skin affections, eczema, prurigo. Apply in 1–2 p. c. solutions of alcohol 3 vols. + water 1, or in 1–10 p. c. ointments of vaseline or wool fat.

Thymol Iodide. Thymolis Iodidum. Aristol, *U.S.P.*

Europhen. Di-iso-butyl-ortho-cresol-iodide.



Obtained similar to aristol, but iso-butyl-ortho-cresol is used instead of thymol. It is an amorphous golden-yellow powder, saffron-like odor, 5 times as bulky as iodoform, soluble in alcohol, ether, chloroform, olive oil (4), insoluble in water or glycerin; melts at 110° C. (230° F.), forming a clear brown liquid; contains iodine 28 p. c. Antiseptic, germicide, bactericide. Possesses about the same power, and used like iodoform for wounds, ulcers, burns, psoriasis, eczema, lupus, chancres, rhinitis, in ointment. Dose, gr. $\frac{1}{2}$–2 (.03–.13 Gm.).

Bismuth Oxyiodogallate. Airol. Airoform. Airogen.

$$C_6H_2(OH)_3CO_2(BiOHI)=C_6H_2\begin{cases}-OH\\-OH\\-OH\\-COOBi\end{cases}\begin{matrix}\\\\\\<\begin{matrix}OH\\I\end{matrix}\end{matrix}$$

Obtained by heating freshly precipitated bismuth oxyiodide (35), water (50), gallic acid (18.8) until grayish-green powder. It is a grayish-green, odorless, tasteless powder, turning red by moisture, thereby losing iodine; contains Bi_2O_3 44.5 p. c., iodine 24.8 p. c. Antiseptic; good substitute for iodoform; abscesses, burns, wounds, chancres, metritis, rhinitis, vaginitis, ulcers; in powder, ointment (10–20 p. c.) with lard, vaseline, glycerin.

Bsimuth Tribromophen-ate-ol. Xeroform, Bromphenolis $(C_6H_2Br_3O)_2$-$BiOH + Bi_2O_3$.

Obtained by combining chemically equal quantities of bismuth hydroxide and tribromphenol. It is a yellowish-green, odorless, tasteless, insoluble powder; contains Bi_2O_3 50 p. c. Intestinal antiseptic; acute and chronic enteritis, burns, infected wounds, ulcers; in place of iodoform.

Antiseptin. Boro-thymol Zinc Iodide.

This is a mixture of zinc sulphate (85), zinc iodide (2.5), thymol (2.5), boric acid (10). Antiseptic for wounds, ulcers, etc.

8. Di-hydroxy Phenol Derivatives.

Guaiacol. Guaiacol. Guaiacolum, $C_7H_8O_2$, *U.S.P.*

Guaiacol Carbonate. Guaiacolis Carbonas,, *U.S.P.*

Guaiacol Benzoate, Guaiacolis Benzoas. Benzosol, Benzoyl Guaiacol, $C_6H_4OHC_6H_5CO_2$.

Obtained by acting on the potassium salt of guaiacol with benzoyl chloride. It is a colorless crystalline powder, odorless, tasteless, soluble in alcohol, chloroform, ether, insoluble in water; melts at 56° C.

(133° F.); alcoholic solution of potassium hydroxide saponifies it, sulphuric acid turns it lemon-yellow, but ferric chloride produces no color in alcoholic solutions. Dose, gr. 5–30 (.3–2 Gm.).

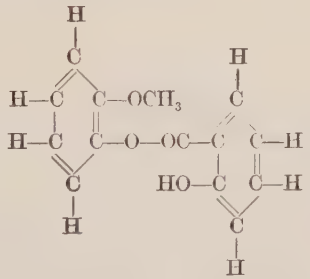
Guaiacol Cinnamate, Guaiacolis Cinnamas. Styracol. Cinnamyl Guaiacol.

$$C_6H_5CH.CH.CO_2C_6H_4OCH_3=C_6H_4\begin{cases}OCH_3 & (1)\\ OCOCH=CHC_6H_5 & (2)\end{cases}$$

Obtained by acting on guaiacol with cinnamyl-chloride, heating on water-bath, crystallizing from boiling alcohol. It is in white needle crystals, soluble in ether, chloroform, insoluble in water. Dose, gr. 2–10 (.13–.6 Gm.).

Guaiacol Salicylate. Guaiacolis Salicylas. Guaiacol Salol.

$C_6H_4OHCO_2,C_6H_4OCH_3=$



Obtained by acting on a mixture of sodium-guaiacol and sodium salicylate with phosphorus oxychloride. It is a white crystalline powder, analogous to salol, soluble in alcohol, chloroform, ether, insoluble in water. Used for same purposes as creosote, being less valuable and less irritating to the intestinal canal and kidneys; phthisis, external tubercle, lupus, cough, expectoration, antiseptic. The benzoate splits in the system into guaiacol and benzoic acid, and so possibly do the others separate into their original components; the cinnamate is useful in gleet, vesical catarrh, diarrhea. Dose, gr. 5–30 (.3–2 Gm.).

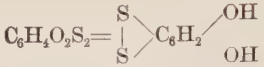
Eugenol. Eugenol. Eugenic Acid, $C_{10}H_{12}O_2$, *U.S.P.*

Eugenol Acetamide, $C_{10}H_{11}O_2,COCH_2NH_2$.

Obtained by acting on chloracetic acid with the sodium salt of eugenol, producing eugenol acetic acid; this being changed to the ethyl-ester is treated with alcoholic ammonia, giving thus the amide. It crystallizes in fine needles, melts at 110° C. (230° F.). Anesthetic, antiseptic, similar to cocaine; dentistry, etc.

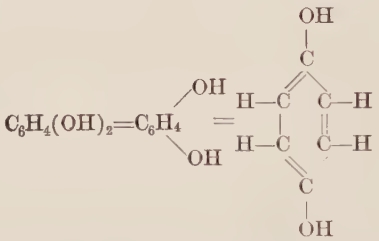
Resorcin-ol,-um.—Resorcin, Meta-di-hydroxy-benzene, *U.S.P.*

Thioresorcin.



Obtained by heating resorcinol (1), sodium hydroxide (3), and sulphur (3) with water until solution effected; acidify the solution to get flocculent precipitate, dry. It is a yellowish amorphous powder, soluble in alkalies, carbonates, and sulphides, insoluble in ordinary reagents. Antiseptic, similar but inferior to iodoform.

Hydroquinone. Hydrochinone. Quinol.—Hydroquinol, Para-di-hydroxy-benzene.



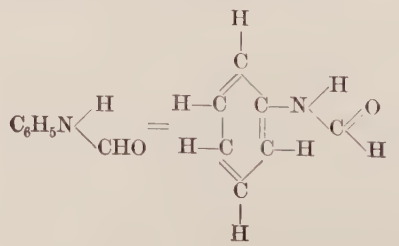
Obtained by oxidizing aniline with potassium dichromate and sulphuric acid, then reducing the resulting quinone ($C_6H_4O_2$) with acid sodium sulphite (sulphurous acid). It crystallizes from water in hexagonal prisms, which heated sublime undecomposed; soluble in alcohol, ether, hot water, slightly in cold water, melts at 169° C. (336° F.), it reduces $AgNO_3$ solution on warming, and Fehling's solution at ordinary temperature. Antipyretic, antiseptic; fevers of phthisis and pneumonia. Dose, gr. 10–20 (.6–1.3 Gm.).

Pyrogallol. Pyrogallic Acid. Tri-hydroxybenzene, *U.S.P.*

9. Benzene Derivatives Containing Nitrogen. Amido Derivatives.

The best known amine of this series is aniline, $C_6H_5NH_2$. In aniline the ammonia residue, NH_2, replaces 1 of the hydrogen atoms in benzene (C_6H_6); these hydrogen atoms in NH_2 may be replaced by hydrocarbon or acid residues.

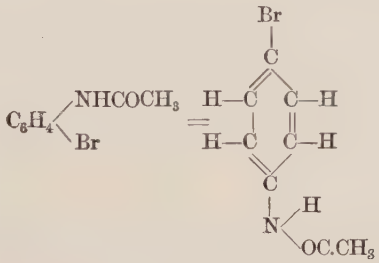
Formanilide. Formanilidum. Phenylformamide.



Obtained by distilling a mixture of aniline and oxalic acid (formic acid)—$C_6H_5HN_2 + H_2C_2O_4 = C_6H_5NHCOH + CO_2 + H_2O$. It is in colorless prismatic needles or crystals, soluble in alcohol, partially in water, melts at 46° C. (115° F.), diluted acids decompose it into aniline and formic acid. Antipyretic, antineuralgic, analgesic. Dose, gr. 2–5 (.13–.3 Gm.).

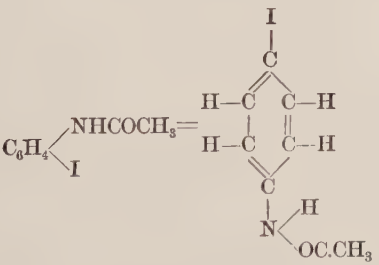
Acetanilid. **Acetanilidum.** **Antifebrin,** C_8H_9NO, *U.S.P.*

Antisepsin. **Asepsin.**—Acetbromanilid, Para brom-acetanilid.



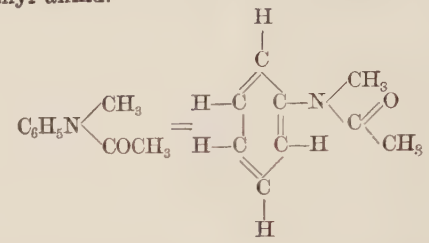
Obtained by adding bromine to a solution of acetanilid in acetic acid. The product is purified by crystallization from alcohol. It is in colorless, monoclinic prisms, soluble in alcohol, insoluble in water, melts at 166° C. (331° F.). The ortho-compound is more soluble in alcohol, melts at 99° C. (210° F.). Antiseptic, antipyretic, analgesic; typhoid fever, pneumonia, phthisis; locally to wounds, bites. Dose, gr. 3–8 (.2–.5 Gm.), ter die.

Iodoacetanilid. **Iodoantifebrin.** **Para-iodo-acetanilid.**



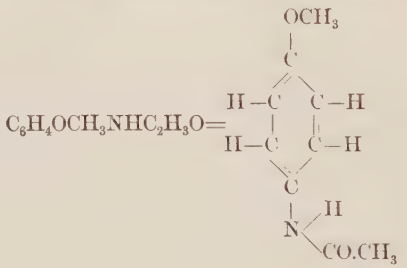
Obtained by heating together acetic acid and para-iodo-aniline. It is in colorless, rhombic tablets, odorless, tasteless, soluble in alcohol, acetic acid, hot water, slightly in cold water, melts at 181° C. (358° F.). Antipyretic, analgesic, anodyne. Dose, gr. 1–5 (.06–.3 Gm.).

Methylacetanilid. Methylacetanilidum. Exalgine. Methyl-phenylacetamide, Acetmethyl-anilid.



Obtained by acting on mono-methyl-aniline $\left(C_6H_5N\begin{matrix}CH_3\\H\end{matrix}\right)$ with acetylchloride. Methylacetanilid is in needles, or in long, tablet-like crystals, soluble in alcohol, slightly so in water, melts at 102° C. (215° F.). Antineuralgic, analgesic, antiseptic; neuralgia, chorea, rheumatism, sciatica, superior to antipyrine. Dose, gr. 1–5 (.06–.3 Gm.).

Methacetin. Para-acetanisidin.—Para-oxy-methyl-acetanilid.



Obtained by the following steps:

(1) C_6H_5OH Phenol

(2) $C_6H_4\begin{matrix}OH\\NO_2\end{matrix}$ Para-nitro-phenol

(3) $C_6H_4\begin{matrix}OCH_3\\NO_2\end{matrix}$ Para-nitro-anisol

(4) $C_6H_4\begin{matrix}OCH_3\\NH_2\end{matrix}$ Anisidin

(5) $C_6H_4\begin{matrix}OCH_3\\NHCOCH_3\end{matrix}$ = Methacetin.

This approximates closely to phenacetin; occurs in colorless, odorless scales, soluble in alcohol, acetone, glycerin, fatty oils, slightly in water, benzene, and ether. Antipyretic; typhoid, rheumatism. Dose, gr. 2–8 (.13–.5 Gm.).

Acetphenetidin. Acetphenetidinum. Phenacetin, *U.S.P.*

Thermodin. Phenacetin-urethane. Acetyl-para-ethoxy-phenyl-urethane, $C_{13}H_{17}NO_4$ This compound of phenacetin and urethane is obtained

by the action of ethyl chloro-carbonate on paraphenetidin, thereby forming paraethoxyphenyl-urethane, which is converted into the ethyl form by heating with acetic anhydride. Occurs in colorless, odorless, tasteless crystals, melting at 86° C. (187° F.), insoluble in water. Analgesic, antipyretic, antiseptic; typhoid, pneumonia, influenza, tuberculosis, febrile conditions in general. Dose, analgesic, gr. 15–20 (1–1.3 Gm.); antipyretic, gr. 5–10 (.3–.6 Gm.).

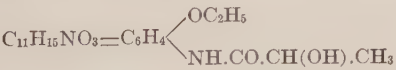
Chinaphenine. Quinine Carbo-phenetidide. Phenetidin Quinine Carbonic Acid Ester, $C_{29}H_{33}N_3O_4$.

Obtained by the action of quinine on p-ethoxyphenyl carbamic acid chloride. Occurs as a white, odorless, tasteless powder, soluble in alcohol, ether, chloroform, benzene, sparingly in water, forms soluble salts with acids and by latter decomposed with liberation of quinine. Antiperiodic, antipyretic, anodyne—resembling quinine and phenacetin combined with the advantages of tastelessness and freedom of cinchonism. Malaria, neuralgia, grippe, whooping-cough, etc. Dose, gr. 2 5–15 (.13–.3–1 Gm.).

Holocaine. Holocainum. Phenacaine. Para-diethoxyethenyl-diphenyl-amidine, $OC_2H_5.C_6H_4NHC.CH_3.N.C_6H_4.O.C_2H_5 + H_2O$.

Obtained by combining in molecular quantities phenacetin and paraphenetidin, when water separates, leaving the base—$OC_2H_5.C_6H_4NHC.O.CH_3 + H_2N.C_6H_4.O.C_2H_5 = OC_2H_5.C_6H_4NHC.CH_3.N.C_6H_4.O.C_2H_5 + H_2O$. It occurs in beautiful white needles, which melt at 120° C. (248° F.), soluble in water (40), undecomposed by boiling, which should be accomplished in a porcelain vessel as the solutions attack glass. The hydrochloride, in white crystals, is the salt mostly used, in 1 p. c. solution; it is slightly bitter, neutral, and may be kept for months without change. Local anesthetic, germicide, antiseptic, active muscle poison; substitute for cocaine in ocular surgery. The anesthesia is produced within a minute and lasts for a quarter of an hour, the burning being about as intense as that following cocaine. Unlike cocaine, it does not change the pupil, the accommodation, or intraocular pressure, does not contract bloodvessels, and additionally acts as an antiseptic. The disadvantages are that it requires to be renewed in 10 to 15 minutes, and is 5 times more toxic than cocaine, hence cannot be used hypodermically; 1 p. c. solution causes a degree of anesthesia equal to a 3–4 p. c. solution of cocaine.

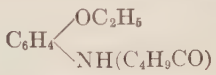
Lactophenin. Lactopheninum.—Lactyl-p-phenetidin.



Obtained by allowing lactic acid to act on phenetidin in the presence of dehydrating substances. It is more soluble than phenacetin,

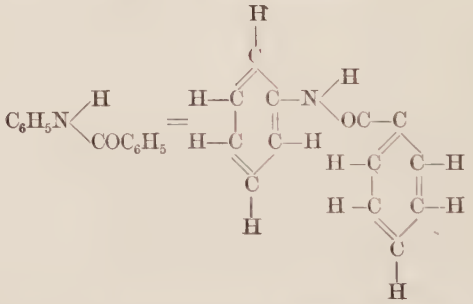
and differs from it only in using lactic instead of acetic acid; occurs as a bitter, odorless, crystalline powder, soluble in alcohol (9), water (320), melts at 118° C. (244° F.). Antipyretic, sedative, analgesic, hypnotic (between sulphonal and urethane); better tolerated than antipyrine, occasioning neither collapse nor cyanosis; rheumatism, pneumonia, typhoid and scarlet fevers, influenza, septicemia. Dose, gr. 8–15 (.5–1 Gm.).

Sedatin. Para-valeryl-amido-(phenetol) phenetidin.



Obtained by acting on para-amido-phenetol with valeric acid or valeryl chloride. It crystallizes in needles, slightly soluble in acetone, chloroform, ether, insoluble in water. Resembles antipyrine; sedative, antineuralgic. Dose, gr. 1–5 (.06–.3 Gm.).

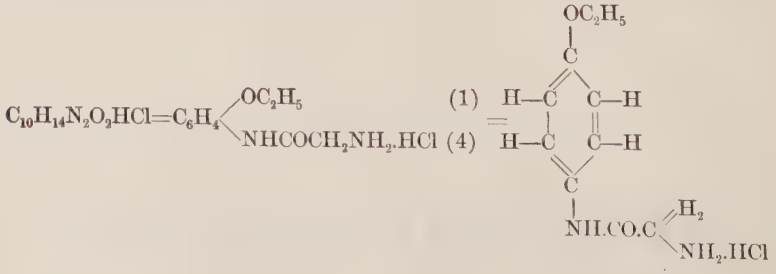
Benzanilid. Benzoyl-anilid. Phenylbenzamide.



Obtained by acting on aniline with benzoyl chloride in the presence of sodium hydroxide. It is in colorless scales, soluble in cold (58), hot alcohol (7), insoluble in water; melts at 162° C. (324° F.).

Benzanilid bears the same relation to benzoic acid that acetanilid does to acetic acid. Antipyretic, especially in fevers of children. Dose, gr. 2–8 (.13–.5 Gm.); children gr. 1–5 (.06–.3 Gm.).

Phenocoll Hydrochloride. Phenocollum Hydrochloridum.—Glycocoll-para-phenetidin hydrochloride.



Obtained by the action of chlor-acetyl chloride on para-amido-phenetol, treating the resulting product with ammonia. This is a result of many attempts to form a soluble phenacetin; it is a white crystalline powder, soluble in water (20). When boiled with acids or alkalies it is broken up into phenacetin and glycocoll, and this latter base is precipitated always upon adding ammonia, alkalies, or alkaline carbonates to any of its solutions. Antipyretic, antineuralgic, antirheumatic, diaphoretic; hectic fever, chronic and acute rheumatism, neuralgia, hypnotic. Dose, gr. 5–15 (.3–1 Gm.), in capsules.

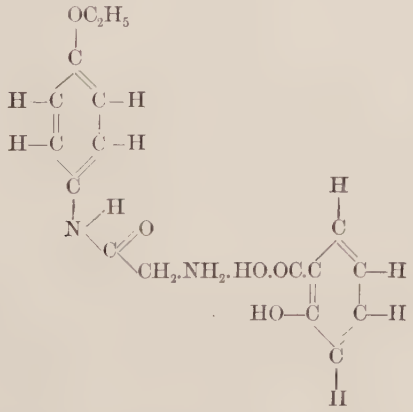
Gallanilide. Gallanol. Gallinol.

$$C_6H_5NH,CO,C_6H_2(OH)_3$$

Obtained by heating aniline to 150° C. (302° F.) for an hour with tannic or gallic acid ($C_6H_2(OH)_3COOH$), treating mixture several times with very dilute hydrochloric acid, when the residue (gallanilide) will crystallize from boiling water; the resulting product is purified by crystallization from diluted alcohol. In colorless, bitter crystals, when free from water melts at 205° C. (401° F.), soluble in hot water, alcohol, ether, or alkalies, slightly in cold water. Chiefly externally for skin diseases, instead of chrysarobin.

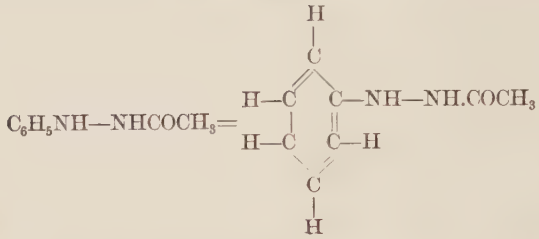
Phenocoll Salicylate. Phenocollum Salicylicum. Salocoll.

$C_6H_4(OC_2H_5)NHCOCH_2(NH_2)C_7H_6O_3=$



This is soluble in hot water, from which it crystallizes in fine needles; its aqueous solution is neutral in reaction and has a sweet taste. Antipyretic, antirheumatic; combines properties of phenocoll and salicylic acid. Dose, gr. 5–15 (.3–1 Gm.).

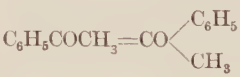
Hydracetin. Pyrodine.—Acetyl-phenyl-hydrazine.



Obtained by heating together acetic anhydride, or acetic acid and phenyl-hydrazine, dissolving in boiling water, crystallizing. It is in colorless, shining, odorless, tasteless crystals, soluble in alcohol, hot water; melts at 128° C. (263° F.); when boiled with HCl splits into acetic acid and phenyl-hydrazine hydrochloride. Antipyretic, antineuralgic; hectic fever of phthisis, night-sweats. Dose, gr. $\frac{1}{6}$–1 (.01–.06 Gm.), ter die. Externally—allied in effect to pyrogallol and chrysarobin in skin diseases (psoriasis, etc.); in ointment 5–10 p. c.; when stronger may poison the system by absorption.

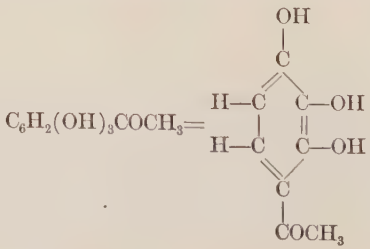
VI. Aldehydes and Ketones.

Hypnone. Acetophenone.—Phenyl-methyl-ketone.



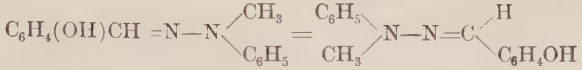
Obtained 1. By distilling a mixture of calcium acetate and benzoate. 2. Acting on benzene in the presence of $AlCl_3$ with acetyl chloride. It is in white crystals, melting at 20° C. (69° F.); when in liquid form it is slightly yellow, bitter almond odor, bitter taste, hence objectionable to some persons. Hypnotic, but somewhat uncertain. Dose, gr. or ♏v–15 (.3–1 cc. or Gm.), which must be increased largely upon usage.

Gallacetophenone. Tri-oxy-acetophenone. Alizarine Yellow.



Obtained by heating to 145–150° C. (293–302° F.) for a short time a mixture of pyrogallol 1, zinc chloride and glacial acetic acid, each $1\frac{1}{2}$; to this hot fused mass add water, when gallacetophenone separates out, which may be purified by crystallizing from hot water. It occurs in dirty, flesh-color, powdery crystals, soluble in alcohol, ether, glycerin, hot water, or cold water (600). Antiseptic; skin affections (psoriasis, etc.), in 10 p. c. solutions or ointments, being a good substitute for pyrogallol, as it does not stain nor poison so easily.

Agathin. Salicyl Aldehyde-methyl-phenyl-hydrazine. Salizone.



Obtained by the direct union of methyl-phenyl-hydrazine and salicylic aldehyde. It is in small greenish crystals, soluble in alcohol, benzene, ether, insoluble in water. Antineuralgic; neuralgia, rheumatism. Dose, gr. 5–10 (.3–.6 Gm.).

8. Carboxyl Derivatives (CO_2H).

Benzoic Acid. Acidum Benzoicum, $C_7H_6O_2$, *U.S.P.*

Gluside. Glusidum. Benzosulphinidum, Saccharin, *U.S.P.*

Soluble Gluside. Glusidum Solubile, *U.S.P.*

9. Oxybenzoic (Salicylic) Derivatives.

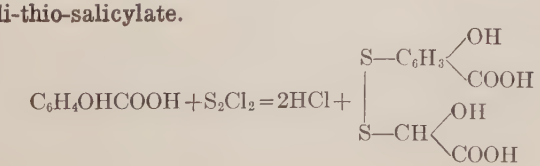
Salicylic Acid. Acidum Salicylicum, $C_7H_6O_3$, *U.S.P.*

Methyl Salicylate. Oil of Wintergreen, $C_6H_4\begin{matrix}OH\\COOCH_3\end{matrix}$, *U.S.P.*

Di-iodo-salicylic Acid, $C_6H_2I_2(OH)COOH$.

Obtained by adding to an alcoholic solution of salicylic acid iodine and iodic acid. Occurs as a crystalline powder, sweetish taste, melts at 220–230° C. (428–446° F.) with decomposition, soluble in alcohol, ether, boiling water (660), cold water (1500). Analgesic, antiseptic, antipyretic. Dose, gr. 5–20 (.3–1.3 Gm.).

Sodium di-thio-salicylate.



Obtained by heating together salicylic acid and sulphur chloride. It is a gray, hygroscopic, amorphous powder, soluble in water. Antiseptic, antipyretic, analgesic. Dose, gr. 5–15 (.3–1 Gm.).

Phenyl Salicylate. Phenylis Salicylas. Salol. $C_6H_5C_7H_5O_3$, *U.S.P.*

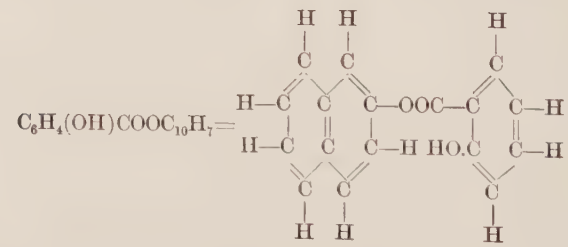
Acetylsalicylic Acid. Acidum Acetylsalicylicum. Aspirin, *U.S.P.*

Novaspirin Disalicylic Ester of Anhydromethylene Citric Acid. Salicitrin, $C_{21}H_{16}O_{11}$.

Obtained by treating methylene citric acid with phosphorus pentachloride, and treating the resulting dichloride of the acid with salicylic acid. It is a white, odorless, crystalline powder, obtained by the action of methylene citric acid dichloride on salicylic acid, is soluble in alcohol, slightly in water, chloroform, ether, benzene, decomposed in the intestine, not in the stomach, therefore causing no irritation to latter organ; heated in test-tube melts, liberating formaldehyde; contains salicylic acid 62 p. c. Similar to aspirin, but possibly a better preparation from being unattended by secondary effects; rheumatic, gouty, and neuralgic conditions, asthma, coryza, influenza, tonsillitis. Dose, gr. 5–15 (.3–1 Gm.), ter die.

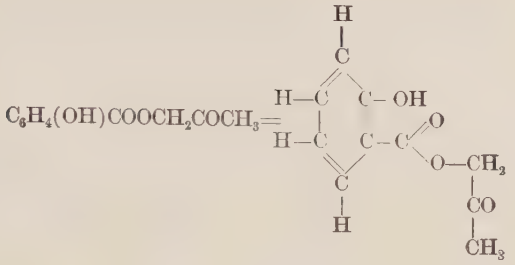
Meta-cresalol, $C_6H_4(OH)CO_2C_6H_4CH_3$, and **Para-cresalol,** $C_6H_4(OH)CO_2C_6H_4CH_3$, are made by condensation of salicylic acid with either meta- or para-cresol. Both occur in colorless, odorless, tasteless crystals, and are used like salol. Dose of either, gr. 5–30 (.3–2 Gm.).

Betol. Naphtho-salol. Naphthyl Salicylate, Salinaphthol.



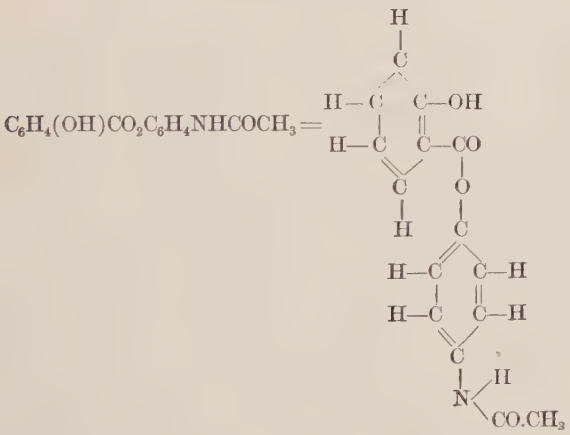
Obtained by replacing a hydrogen atom in salicylic acid by naphthol group ($C_{10}H_7$), instead of phenol group (C_6H_5) as in salol. Heat together beta-naphthol sodium, sodium salicylate, and phosphorus oxychloride. It is a white, tasteless, inodorous, crystalline powder, soluble in boiling alcohol, ether, benzene, warm fixed oils, insoluble in water or glycerin. Intestinal antiseptic; articular rheumatism, vesical catarrh, cystitis; instead of salol. Dose, gr. 2–5 (.13–.3 Gm.).

Salacetol. Acetol Salicylate. Salantol.



Differs from salol in replacing the phenol group (C_6H_5) by acetone radical (CH_2—CO—CH_3), and obtained by heating together sodium salicylate and mono-chlor-acetone—$C_6H_4(OH)COO[Na + Cl]CH_2$-$COCH_3 = NaCl + C_6H_4(OH)COOCH_2COCH_3$. Occurs in needle crystals, bitter taste, melts at 71° C. (160° F.), soluble in alcohol (15), castor oil (25), olive oil (30), water (2200). Similar to salol; rheumatism, diarrhea. Dose, gr. 15–30 (1–2 Gm.).

Salophen. Salophenum. Phenetsal.—Acetyl-para-amido-phenol-salicylate, Acetparamidophenol-salicylsäureester, Acetparamidosalol.

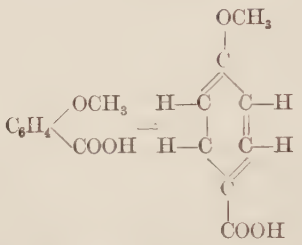


Obtained by a complicated process resembling somewhat that for salol—para-nitro-phenol-salicylate ($C_6H_4(OH)COOC_6H_4NO_2$) is formed by condensation of salicylic acid and para-nitro-phenol; this upon reduction gives para-amido-phenol-salicylate ($C_6H_4(OH)COOC_6$-H_4NH_2), and this acted on by acetic acid gives salophen. It is in white scales, odorless, tasteless, soluble in alcohol, ether, alkalies, insoluble in water, melts at 188° C. (370° F.); contains 51 p. c. of salicylic acid. Antiseptic, antipyretic. As a substitute for salol or salicylic

acid in acute articular rheumatism, also as an intestinal antiseptic. It is much safer and equally as efficient as salol. Dose, gr. 5–15 (.3–1 Gm.).

10. Para-oxybenzoic Derivatives.

Anisic Acid. Methyl-para-oxy-benzoic Acid.



Obtained 1. By the oxidation of para-cresyl-methyl ether. 2. Heating methyl iodide with potassium para-oxy-benzoate. 3. The oxidation of anethol. It is a light, colorless crystalline powder, soluble in alcohol, ether, slightly in water; melts at 184° C. (363° F.), boils at 277° C. (530° F.). Antiseptic, antirheumatic, neuralgia, acts like salicylic acid; usually given as sodium anisate. Dose, gr. 2–5–10 (.13–.3–.6 Gm.).

Orthoform. Orthoformum. Methyl-para-amido-meta-oxybenzoate,

$$C_6H_3OH(NH_2)C_2H_3O_2.$$

This is a permanent, colorless, odorless, tasteless, crystalline powder, slightly soluble in water; the chloride quite soluble, but so acid as often to preclude its use. Local anesthetic, analgesic, antiseptic. Has no action on sound mucous membranes or unbroken skin, and serves best as a dusting-powder to painful abrasions, burns, ulcers, or to gastric cancers and ulcers. Anesthesia is induced as quickly as by cocaine, and is more persistent (many hours to several days), owing to the feeble solubility and tardy elimination of the drug, but it does not penetrate the tissues to the same extent, benumbing only those nerve-ends with which it comes in direct contact. May apply 5 p. c. solution of the chloride in diluted alcohol, and 10–20 p. c. ointments. Dose, gr. 5–10 (.3–.6 Gm.).

Orthoform-new. Orthocaine. Methyl Metamidoparoxybenzoate. Meta-amido-para-oxybenzoate of Methyl, $C_6H_3.(COO.CH_3)(NH_2)(OH).1:3:4.$

Obtained by the nitration of methyl paroxybenzoate and reduction of the resulting nitro-product. Occurs as a fine, white, neutral, odorless, tasteless, crystalline powder, melting at 141° C. (286° F.), soluble in alcohol (6), ether (50), insoluble in water, but decomposed when

boiled in it, yielding methyl alcohol and paroxybenzoic acid, incompatible with alkalies and their carbonates. Substitution for orthoform, which has proven unsatisfactory. Local anesthetic, analgesic, resembling cocaine, but owing to insolubility does not penetrate tissues, antiseptic, non-toxic; dentistry, catarrh, hay fever, and internally to relieve pain of gastric ulcer, etc. Dose, gr. 8–15 (.5–1 Gm.), emulsion; apply as a dusting-powder, or with lactose for insufflation, or dissolve in ether, oil, wool fat, etc.

Orthoform-new Hydrochloride is the most important salt, being soluble in water (10).

Anesthesin.—Paramidobenzoic acid ethyl ester, $C_6H_4(NH_2)(COOC_2H_5)$.

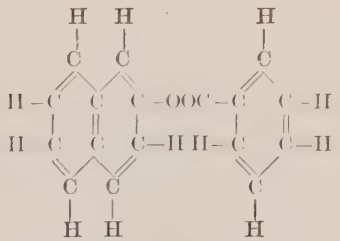
Ethylate paramidobenzoic acid by action of sulphuric acid and alcohol, reduce ether obtained by action of zinc and hydrochloric acid. It is a white, crystalline powder, melting at 90° C. (194° F.), odorless, tasteless, but benumbing tongue, soluble in ether, benzene, alcohol (6), practically insoluble in water, but decomposed by long boiling in it or warming with dilute alkalies. *Incompatibles:* Alkalies and their carbonates. Substitute for cocaine—local anesthetic, similar in action to orthoform, but free from irritation and toxicity; owing to insolubility effect is more prolonged than cocaine, and cannot be used hypodermically. Locally—more effective when skin is broken—in rhinologic and laryngeal affections, urethritis, anesthetizing abraded surfaces, burns, ulcerations, painful skin affections; internally to relieve pain of gastralgia, ulcer, and cancer of stomach. Dose, gr. 5–8 (.3–.5 Gm.), pastilles, dusting-powder (pure or diluted), ointment (10 p. c.), suppositories.

11. Naphthalene Derivatives.

Betanaphthol. Betanaphthol. Naphtol, $C_{10}H_7OH$, *U.S.P.*

Benzonaphthol. Naphthyl Benzoate. Benzoyl-naphthol. Beta-naphtholum Benzoicum.

$H_{17}C_{12}O_2 = C_6H_5COOC_{10}H_7 =$



Obtained by acting on beta-naphthol with benzoyl chloride; reaction begins at 125° C. (257° F.) and is complete in half an hour at 170° C. (408° F.), when the product is washed several times with dilute solu-

tion of sodium hydroxide and recrystallized from hot alcohol. It is in colorless needles, soluble in alcohol, chloroform, slightly in water, melts at 107° C. (225° F.). *Incompatibles:* Antipyrine, camphor, ferric chloride, menthol, phenol, etc. Local and intestinal antiseptic; gastric fermentation, chronic diarrhea. Dose, gr. 4–8 (.26–.5 Gm.), in capsule, or suspended in syrup and water; may be applied in powder.

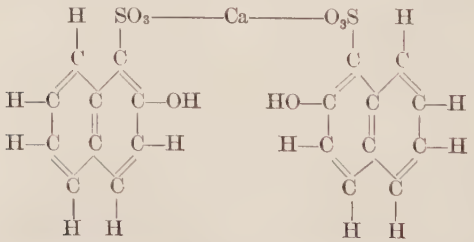
Di-iodo-beta-naphthol. Naphthol-aristol, $C_{10}H_5I_2OH$. — This compound is prepared like aristol; greenish-yellow, slightly soluble in alcohol, ether, acetic acid, very soluble in chloroform, insoluble in water. Antiseptic; locally like iodoform.

Naphthol-bismuth. Betanaphthol-bismuth. Bismuthi Betanaphtholas. Orphol, $C_{10}H_7O.Bi_2O_2OH$.

Obtained by acting on bismuth ternitrate dissolved in dilute glycerin or acid with alkaline solution of beta-naphthol. It is a light brown, odorless powder, slight aromatic taste, insoluble in water, alcohol, and splits up in the duodenum into naphthol and bismuth hydroxide. Intestinal astringent, antiseptic, substitute for iodoform; cholera infantum, gastro-intestinal catarrh, typhoid fever. Dose, gr. 5–8 (.3–.5 Gm.), 5–6 times daily.

Asaprol. Abrastol Calcium beta-naphthol-alpha-mono-sulphonate.

$$(C_{10}H_6\beta OH\alpha SO_3)_2Ca+3H_2O = \begin{matrix} HO.C_{10}H_6.SO_3 \\ HO.C_{10}H_6.SO_3 \end{matrix} \!\!>Ca+3H_2O=$$



Obtained by neutralizing the free acid beta-naphthol-alpha-mono-sulphonate with calcium carbonate, concentrating the solution, crystallizing. It occurs as a white powder, soluble in water or alcohol, neutral reaction, not altered by heat, non-irritant, non-toxic, does not affect digestion, and is eliminated by the kidneys. Antiseptic, germicide, antipyretic, analgesic; influenza, typhoid fever, rheumatism, chorea, malaria. Dose, gr. 5–20) .3–1.3 Gm.).

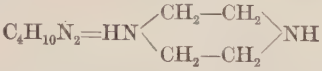
Anthrarobin. Des-oxy-alizarin.—Dioxy-anthrol, Leuko-alizarin.

$$C_{14}H_{10}O_3=C_6H_4\!\!<\!\!\begin{matrix} C(OH) \\ | \\ CH \end{matrix}\!\!>\!C_6H_2(OH)_2$$

Obtained by acting on alizarin with nascent hydrogen—$C_{14}H_8O_4+H_4 = C_{14}H_{10}O_3 + H_2O$. It occurs as a yellowish powder, soluble in caustic alkalies, glycerin, or alcohol, insoluble in water or diluted acids. In skin diseases like chrysarobinum; ointment (10–20 p. c.). See page 324.

VII. ORGANIC BASES.

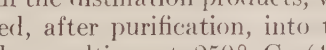
Piperazine. Piperazina. Piperazidine.—Diethylene-diamine, Ethylene-imine, Arthriticine.



Obtained by the action of ammonia upon ethylene bromide or chloride, giving a mixture of salts of different bases, including diethylene diamine, which is separated by treating solution of mixed salts with excess of sodium nitrite at 70° C. (158° F.), yielding dinitrosopiperazine as crystalline mass, treat with acids or reducing agents, getting ammonia and salts of piperazine, distil with alkalies to obtain pure base. It is in colorless, acicular crystals, soluble in water, less so in alcohol, very hygroscopic; dissolves 12 times more uric acid than will lithium carbonate, and its urate compound is soluble in water (50), lithium urate in 368. Diuretic. Increases the urea, but diminishes the uric acid in urine; gout, rheumatism, calculi; large doses may produce tremors, clonic spasms, general depression. Dose, gr. 10–15 (.6–1 Gm.).

Lycetol. Dimethyl-piperazine Tartrate, $C_{10}H_{20}O_6N_2$. Obtained by distilling glycerin with ammonium chloride, reducing the dimethylpyrazine, isolated from the distillation products, with sodium, converting base thus obtained, after purification, into the tartrate. It is a white, odorless powder, melting at 250° C. (482° F.), anhydrous, slightly hygroscopic, soluble in water giving acidulous solutions; incompatible with alkalies which liberate the insoluble free base. Diuretic, uric acid solvent, being well tolerated by and free from disturbing effects on stomach; chronic gout, rheumatism, cystitis, lithiasis. Dose, gr. 15–30 (1–2 Gm.), well diluted, preferably with carbonated water, plain or sweetened.

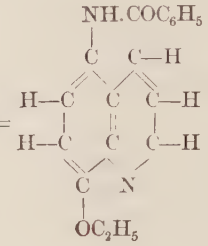
Diaptherin. Oxy-quin-aseptol.—Oxychinaseptol.



Obtained by uniting 2 molecules of ortho-oxy-quinoline with 1 molecule of ortho-phenol-sulphonic acid. It is a bright yellow powder of hexagonal prisms, soluble in water, diluted alcohol, non-caustic and non-toxic, which properties render it preferable to phenol (carbolic acid). Antiseptic, wounds (in 1 p. c. solutions).

Analgen. Benzanalgene.—Ortho-ethoxy-ana-mono-benzoyl-amido-quinoline.

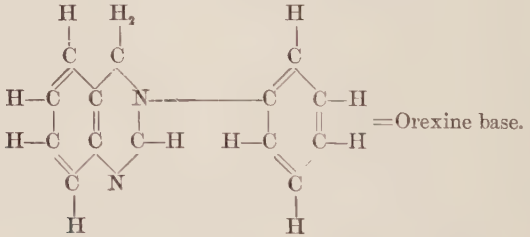
$C_{18}H_{16}O_2N_2=C_9H_5NOC_2H_5NHCOC_6H_5=$



Obtained, by a very complicated process, as a white, neutral, tasteless powder, soluble in hot alcohol or acids, slightly in cold alcohol, insoluble in water, melts at 208° C. (406° F.). Antipyretic, antirheumatic; rheumatism, neuralgia, headache. Dose, gr. 10–15 (.6–1 Gm.).

Orexine Hydrochloride. Phenyl-di-hydro-quinazoline Hydrochloride. Phenzoline. Cedrarine.

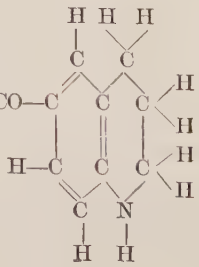
$C_6H_4.NCH.CH_2NC_6H_5HCl=C_{14}H_{12}N_2HCl+2H_2O=$



Obtained by acting on formanilide to make sodium formanilide, then orthonitrobenzyl-formanilide, and finally orexine hydrochloride. It occurs as a white powder, or in acicular crystals, bitter, pungent taste, soluble in alcohol, water (13), insoluble in ether, very irritating to the nostrils; tannate causes no gastric irritation. Stomachic; nausea, dyspepsia, loss of appetite. Dose, gr. 4–8 (.26–.5 Gm.), in wafers, to be accompanied with a large draught of water.

Thalline. Tetra-hydro-para-quin-anisol.

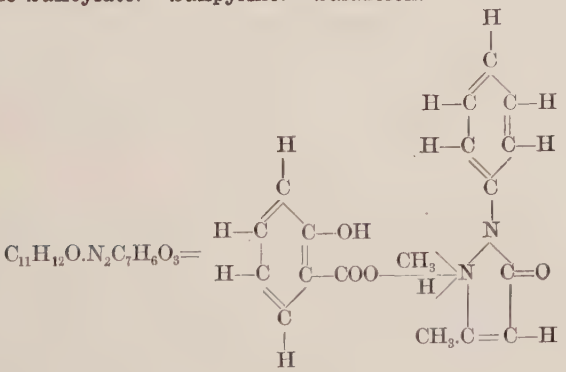
$C_9H_{10}N(OCH_3)=$



Obtained by heating a mixture of para-amido-anisol, para-nitro-anisol, glycerin, sulphuric acid, treating this with tin and hydrochloric acid. The free base at ordinary temperatures is an oily liquid, but on cooling gives yellowish-white crystals, soluble in alcohol, ether, benzene, sparingly in benzin or water, anise-like odor, nauseous, with oxidizing agents gives green color and forms salts with acids. *Thalline Sulphate. Thallinæ Sulphas,* $2(C_{10}H_{13}NO)H_2SO_4$, or $2C_9H_{10}N(OCH_3)H_2SO_4 + 2H_2O$.—Obtained by dissolving thalline in diluted sulphuric acid and crystallizing or granulating; it is the salt mostly used, often being designated simply as thalline. It occurs as a yellowish-white crystalline powder, anise-like odor, nauseous, bitter, saline, pungent taste, soluble in hot water, sparingly in chloroform or ether, cold water (7), alcohol (100); solutions darken with age and exposure to light; contains thalline 76.9 p. c. and sulphuric acid 23.1 p. c. *Thalline Tartrate. Thallinæ Tartras,* $C_{10}H_{13}NO,C_4H_6O_6$.—This is a yellowish-white crystalline powder, resembling the sulphate in appearance and taste, but is much less soluble in water (10); contains thalline 52.2 p. c. and tartaric acid 47.8 p. c. These thalline compounds are antipyretics, germicides, rarely used internally, being poisonous; useful as injections for gonorrhea in 1–2 p. c. solutions.

Antipyrine. Antipyrina, $C_6H_5(CH_3)_2C_3HN_2O$ or $C_{11}H_{12}ON_2$, *U.S.P.*

Antipyrine Salicylate. Salipyrine. Salazolon.



Obtained by the direct union of molecular proportions of antipyrine and salicylic acid, which is accomplished by heating together 57.7 p. c. of the former and 42.3 p. c. of the latter, dissolving in alcohol and crystallizing. It is a white crystalline powder, sweetish taste of salicylic acid, soluble in alcohol, chloroform, ether, boiling water (25), water (200), melts at 91° C. (196.7° F.). Antirheumatic, antineuralgic; chronic articular rheumatism, sciatica. Dose, gr. 2–20 (.13–1.3 Gm.).

Amidopyrine. Amidopyrina. Pyramidon, *U.S.P.*

Hypnal. Chlorpyrine. Chloral Hydrate (Monochloral) Antipyrine, $CCl_3,CH(OH)_2 + C_{11}H_{12}ON_2$.

Obtained by dissolving antipyrine (188) and chloral hydrate (165.5), each separately in water, mixing solutions, and allowing the underlying oily stratum to crystallize. It is in colorless crystals, nearly tasteless, non-irritating to mucous membranes, soluble in water (15), melts at 67.5° C. (154° F.). Hypnotic; analgesic. Dose, gr. 2–20 (.13–1.3 Gm.).

Iodopyrine. Iodoantipyrine. Antipyrine Iodide, $C_{11}H_{11}ION_2$.

Obtained by mixing a hot solution of iodine (1) in alcohol (12) with a solution of antipyrine (1) in alcohol (4); the mixture after several days deposits crystals of iodopyrine; this is a substitute for antipyrine in which 1 hydrogen atom in the benzene nucleus is replaced by iodine. It is in colorless, silky, prismatic, tasteless needles, odorless, soluble in hot water, alcohol, slightly in cold water, melts at 160° C. (320° F.). Causes fall of temperature, with perspiration, without collapse or shivering. Has no advantage over antipyrine. Dose, gr. 2–20 (.13–1.3 Gm.).

Cocaine. Cocaina. Methyl-benzoyl-ecgonine, $C_{17}H_{22}O_4N$, *U.S.P.*

Cocaine Hydrochloride. Cocainæ Hydrochloridum, $C_{17}H_{21}O_4N.HCl$, *U.S.P.*

Eucaine. Eucaina.—The eucaines are synthetic alkaloidal derivatives of triacetonamine and vinyl-diaceton-alkalamine, the former yielding commercial alpha-eucaine hydrochloride, the latter, beta-eucaine hydrochloride, both used as substitutes for cocaine, having the advantage of being less toxic, and aqueous solutions not decomposing on boiling.

Eucaine Hydrochloride. Eucainæ Hydrochloridum, *U.S.P.*

Theobromine. Di-methyl Xanthine, $C_5H_2(CH_3)_2O_2N_4$.

Obtained from the seed of *Theobroma Cacoa* and from xanthine, which is a substance closely related to uric acid. It is in colorless bitter crystals, sparingly soluble in water, alcohol, or ether.

Caffeine. Caffeina (Theine).—Tri-methyl Xanthine, *U.S.P.*

Theobromine Sodio-Salicylate. Theobrominæ Sodio-Salicylas. Diuretin.—Theobrominum Natrio-salicylicum, *U.S.P.*

Diacetylmorphine. Diacetylmorphinæ. Diamorphine. Heroine, $C_{17}H_{17}(C_2H_3O_2)_2ON$.—This alkaloid is produced from morphine by heating acetyl chloride with morphine and purifying. It is a white, odorless, crystalline powder, soluble in water (1700), alcohol (31), chloroform

(1.4), ether (100); saturated alcoholic solution alkaline, melts at 172° C. (342° F.). Dissolve .01 Gm. in a few drops nitric acid—yellow, changing to greenish-blue (green). *Impurities:* Morphine, foreign alkaloids, ammonium salts, readily carbonizable substances. Dose, gr. $\frac{1}{24}$—$\frac{1}{12}$ (.0025–.005 Gm.).

Diacetylmorphine Hydrochloride. Diacetylmorphinæ Hydrochloridum. Diamorphine (Heroine) Hydrochloride.—Obtained by dissolving diacetylmorphine in dilute hydrochloric acid, concentrating, allowing to crystallize. It is a white, odorless, crystalline powder, soluble in water (2), alcohol, insoluble in ether, chloroform, neutral. Lessens irritability of respiratory center, allays cough, does not depress as morphine, neither hypnotic nor analgesic. Manufacture of both now prohibited by law. Dose, gr. $\frac{1}{24}$—$\frac{1}{12}$ (.0025–.005 Gm.).

Tropacocaine Hydrochloride. Tropacocainæ Hydrochloridum. Benzoylpseudotropeine Hydrochloride, $C_{15}H_{19}O_2NHCl$.—Obtained synthetically from tropin by electrolytic reduction, from which get benzoyl derivative that is converted into the hydrochloride. Occurs in colorless needle-shaped crystals, melting at 271° C. (520° F.), soluble in water, solutions keeping several months; heated with hydrochloric acid splits into benzoic acid and tropine, incompatible with alkaloidal reagents. Local anesthetic—resembling cocaine, but only half as poisonous, while anesthesia is quicker and more prolonged and mydriasis much less; ophthalmology, dentistry, being applied in 3–10 p. c. aqueous solutions containing .6 p. c. sodium chloride.

Procaine Hydrochloride. Novocaine. Ethocaine. Ethocaina, *U.S.P.*

Quinine Ethylcarbonate. Euquinine. Euchinin, *U.S.P.*

Stovaine. Stovainum. Benzoyl-ethyl-dimetylaminopropanol Hydrochloride, $C_{14}H_{21}O_2NHCl$.

Obtained by the reaction of benzoyl chloride on *a*-dimethyl-aminopentonal-*b*, a substance produced by the action of ethylmagnesium chloride on methylamino-acetone. Occurs in small brilliant crystals (scales), melting at 175° C. (347° F.), soluble in alcohol, water, the latter solutions being slightly acid and sterilized at 115° C. (239° F.), without decomposition, precipitated by alkaloidal reagents and decomposed by dilute alkalies. Local anesthetic similar to cocaine, but dilates bloodvessels, whereas cocaine contracts them; heart tonic, but only one-half as toxic as cocaine. Dose, gr. $\frac{1}{30}$ (.002 Gm.), in pill; locally in the eye 4 p. c. solution, on other mucous membranes (laryngology, etc.) 5–10 p. c. solutions; hypodermic injection (local anesthesia) 1 p. c. solution.

Opsonins. Bacteria Vaccines. Opsonic Theory.—It is claimed that the blood fluids so modify bacteria germs as to render them readily devoured by the white blood corpuscles (leukocytes, phagocytes), and the elements in the blood fluids causing this effect are called opsonins. These are supposed to act by chemically uniting with and changing the invading bacteria so that they become absorbed by the leukocytes, which are themselves neither stimulated nor otherwise affected. Opsonins in the blood plasma are of many varieties, each special in combating a particular kind of bacteria, while leukocytes of healthy and diseased persons are active alike in the same serum, so that the amount of opsonins present in the blood determines an individual's susceptibility to bacterial invasion.

For treatment must (1) isolate in pure culture the causative microorganism, (2) estimate opsonic power of patient's blood to this microorganism, (3) prepare and standardize a vaccine from this microörganism—provided the opsonic index be at or below normal, (4) inoculate patient with proper dose and frequency of this vaccine, as shown by a systematic estimation of the opsonic content of the patient's blood.

The starting point of opsonins are 24-hour pure cultures of the peculiar disease microörganism causing the particular disease for which the vaccine is given, the culture being removed from the surface of the media by small quantity of sterile salt solution, which holds the germs in suspension. The number of germs in salt suspension is compared with the number of red corpuscles in same quantity of human blood, the density being adjusted by the operator according to his needs in fixing the number of germs for a dose.

Uses.—Tuberculous joints, septicemia, endocarditis, Malta fever, etc. The number of microörganisms for a dose depends upon the disease, condition of patient, and virulency of the microörganism used in preparing the vaccine: Staphylococcus vaccine—three hundred millions; pneumococcus and streptococcus—fifty millions; Gonococcus—ten millions; Tubercle (T. B.)—$\frac{1}{3000}$ $\frac{1}{100}$ of a milligram.

Roentgen-Rays. X-Rays. Radio-activity.—If electric sparks be passed between the poles of a highly exhausted glass tube (Crookes') a faint, straight-lined radiation (cathode rays) emanates from the cathode which consists of a stream of very minute, rapidly moving, negatively charged particles. These cathode rays impinge on the walls of the tube, producing a brilliant fluorescence, while at the same time a new kind of rays (roentgen- or *x*-) pass out in straight lines from the walls of the tube, which are invisible, not easily deflected by a magnet, but very efficient, causing many substances to become luminescent, passing through bodies opaque to ordinary light waves, affecting photographic plates, producing physiological effects on living tissues, and changing insulating media (air, gases, paraffin, etc.) into conductors when passing through them.

Inasmuch as Crookes' tubes are fluorescent while emitting roentgen-rays, it was thought that the latter might be given out, possibly, by various fluorescent bodies. Uranium salts, noted for their fluorescence after exposure to sunlight, were found to affect sensitive plates covered with black paper impervious to ordinary light. Becquerel, working along this line, placed some double sulphate of uranium and potassium on a covered photographic plate, but, owing to a sudden storm obscuring sunlight, thus rendering impossible the exposure of the uranium salt to the sun for the production of fluorescence, he laid away carefully in a dark drawer the plate with the uranium salt upon it. Some days afterward he happily decided to examine this same plate for possible changes, and in the development, much to his surprise, found that it had been affected greatly, thereby discovering the remarkable radiation —Becquerel rays or radio-activity. Any substance, therefore, which like uranium, emits such invisible rays, that affect a photographic plate or pass through opaque substances, is said to be *radio-active*. Madame Curie found in uraninite (pitchblende, a complex substance, and the source of uranium salts) several elements—polonium, actinium, radium—far more radio-active than uranium and its salts.

Radium, although never yet isolated (only 1 Gm. of the salts existing at a cost of $6000), is an alkaline earth resembling barium, with a radio-activity 100,000 times stronger than that of uranium; its salts (bromide, chloride, sulphide) are white, crystalline, grayish in time, self-luminous, imparting luminosity (phosphorescence) and radio-activity to neighboring bodies temporarily, emit heat constantly, reduce silver salts and mercuric chloride, convert white to red phosphorus, and color glass, porcelain, paper, rock-salt, just as cathode rays do.

As sun rays consist of rays of light, heat, and actinic power, so radio-active bodies possess three kinds of rays: *alpha* (α)—having slight penetrating power (completely absorbed by a few centimeters of air or a sheet of paper), being deflected with difficulty by a magnet and consisting of a stream of particles, twice as heavy as the hydrogen atom, positively charged, moving at great velocity; it is to the bombardment of these particles that the self-heating of radium salts is believed to be due; *beta* (β)—having a marked power of penetration and of exciting phosphorescence in a large number of substances (barium platinocyanide, zinc sulphide, etc.), being deflected easily by magnet, similar in character to the cathode rays and consisting of streams of negatively charged "corpuscles" or "electrons," one-thousandth part of the mass of the hydrogen atom, moving at great velocity; *gamma*; (γ)—being a very penetrating kind of roentgen-rays, produced at the moment of sudden expulsion of the *beta* rays, and capable of penetrating a foot-thickness of iron.

Properties and Uses.—Rays of radium salts and roentgen-rays closely resemble. Chiefly in lupus, cutaneous tuberculosis, superficial

epithelioma—the radium salts being applied locally to the affected part in a small rubber bag, box, disc, or cylinder. A radium salt when even thus enclosed and brought near the temple or closed eyes causes the sensation of light, and although no portion of the body can detect its presence, yet a strong influence, similar to roentgen-rays, is exerted upon the tissues. The skin often does not redden until weeks after the exposure, when intractable sores may result, while a small quantity sealed in a glass tube will kill fish when placed into a bowl containing them. The extreme expense and lack of uniformity of the radium salts restrict greatly their use.

PART VI.

THE MICROSCOPE AND ITS USE IN MATERIA MEDICA.

Although it is impossible for all druggists to become experienced with the microscope, yet every one, by a little patience, study, and tact in its use, may learn sufficient to have it serve him often to advantage. One readily admits the importance of such knowledge when he observes that the skilful manipulator, in many cases, shares equal honors with the chemist in determining qualitative (sometimes quantitative) analyses of various substances—in fact, a number of plant-constituents, as starches, oils, acids, sugars, crystals, alkaloids, etc., yield in the hands of chemists and microscopists similar and equally satisfactory results. While it is not the intention here to go very deeply into the subject, it is, however, desired to give that which the average pharmacist, if so disposed, can put with profit into practice. Special laboratory course or various treatises pertinent to this department should be availed of for more extended information.

I. Description of the Microscope.

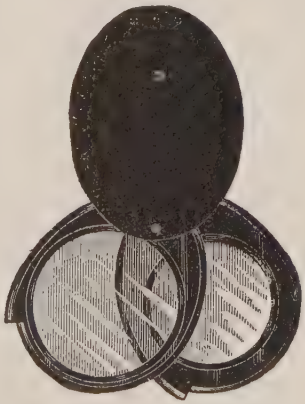
Of these there are two kinds—simple and compound.

The Simple Microscope is only a hand magnifying-glass or linen-tester, and consists of a double convex lens (or several mounted in juxtaposi-

Fig. 474.

Simple microscope (watchmaker's).

Fig. 475.



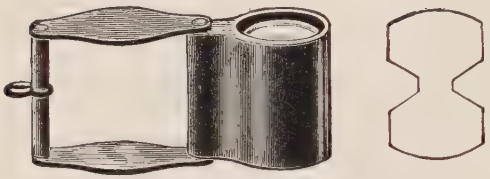
Simple microscope (magnifier).

tion on a common axis), giving an extensive field of view and an erect

image 5–30 times the size of the object. This instrument is valuable in field botanic work, crystallography, deciphering illegible prescriptions, recognizing various fabrics and other objects indistinctly visible by the naked eye.

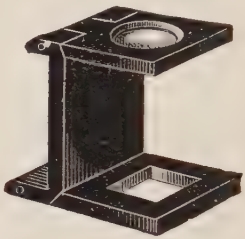
The Compound Microscope is a more complex instrument, and consists of several lenses so separated at focal distances that each one

FIG. 476.



Simple microscope. (CODDINGTON.)

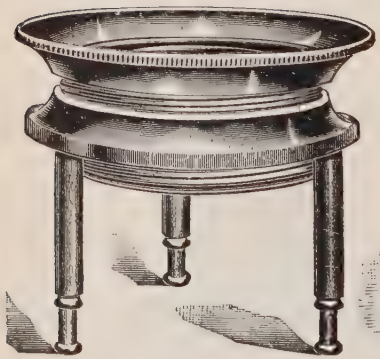
FIG. 477.



Simple microscope (linen-tester).

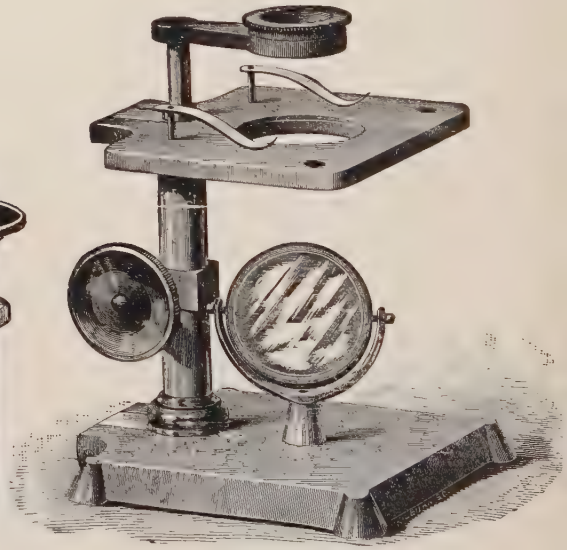
serves to magnify the image transmitted by the preceding one. The higher the magnifying powers used, the smaller becomes the area of the object that is seen through the instrument, and the light being correspondingly diffused over a larger area in the image, the latter

FIG. 478.



Tripod dissecting microscope.

FIG. 479.



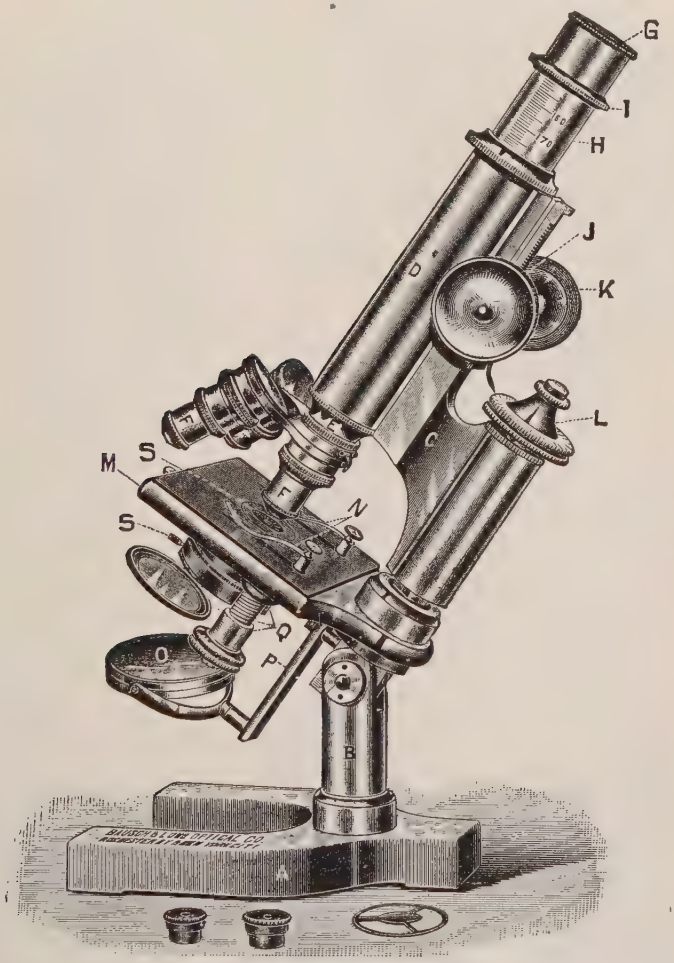
Folding dissecting microscope.

appears less bright. The image is always inverted and magnified 10–4,000 times.

1. *The Ocular or Eye-piece* (G).—This, in the line of vision, is the part nearest to the eye, and has several types—Huyghenian, Conti-

nental, Kellner, Binocular, Solid (all negative), Ramsden, etc. (positive). The first named is used mostly, and consists of two plano-convex lenses (plane surfaces upward) mounted in a short metal tube: the one next to the eye—eye-lens; the one farthest—field-lens. Between these two a diaphragm is so placed as to cut off the blurred

FIG. 480.



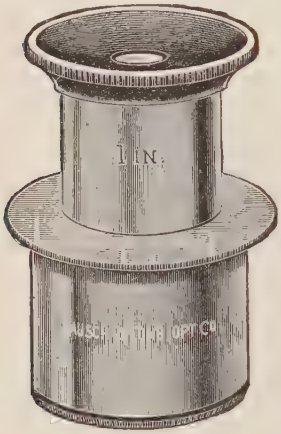
Compound microscope. A, base; B, pillar; C, pillar and arm; D, body; E, nose-piece; F, objective; G, ocular; H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment; L, fine adjustment; N, spring clips; O, mirror; P, mirror bar; Q, diaphragm and substage; R, substage screw; S, stage aperture; T, pillar hinge-joint.

edges of the image, thus giving a flat field and a sharp, round outline to the field of vision. The ocular magnifies the real image produced by the objective as though that image were itself the original object; its magnifying power is inversely proportional to the length—the longer the tube, the lower the power. Oculars are designated as

follows: A–2 inch, B–1½ inch, C–1 inch, D–¾ inch, E–½ inch—the first weakest, the last strongest.

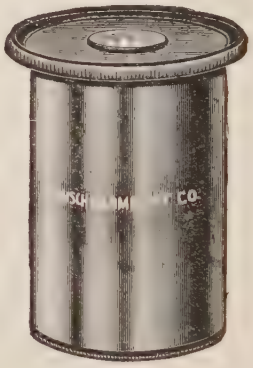
2. *The Objective* (F).—This, in the line of vision, is removed farthest from the eye and is the most essential portion of the instrument; to its many improvements (also further susceptibilities) are

Fig. 481.



Ocular (Huyghenian).

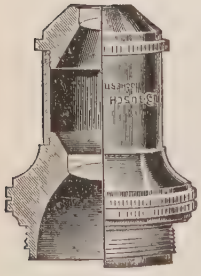
Fig. 482



Ocular (Continental).

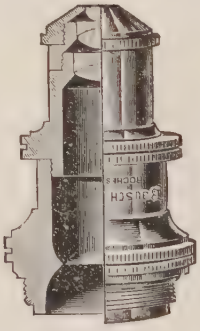
(and will be) due the great advancements in vegetable and animal histology. It consists usually of a front plano-convex lens (convexity upward), together with one, two, or three others, which may vary in shape between plano-convex, concavo-convex, and bi-convex (according to manufacture), working in combination as a single magnifier, thus

Fig. 483.



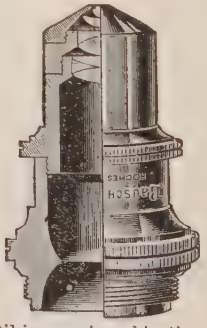
Objective, ⅔-inch.

Fig. 484.



Objective, ⅙-inch.

Fig. 485.

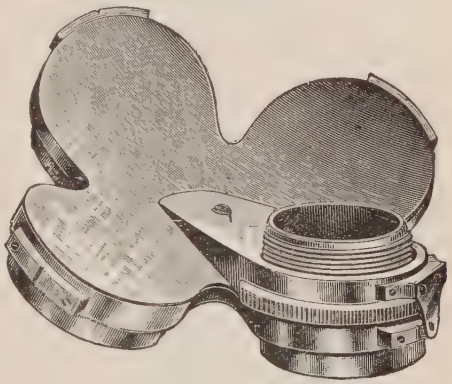


Oil-immersion objective, 1/12-inch.

producing an enlarged inverted and reversed image—this simple image being that which the ocular receives, and in turn magnifies. Objectives may be either *dry* or *immersion*, according as they are used without or with a drop of liquid between the lens and the object; if the liquid used has same refractive power as the glass lens, then it is

called *homogeneous immersion*. Objectives are known by whole numbers and fractions, thus: 4—3—2—1½—1—¾-inch = lower power; ¼—⅕-inch = medium power; $\frac{1}{6}$—$\frac{1}{8}$—$\frac{1}{10}$—$\frac{1}{12}$—$\frac{1}{16}$—$\frac{1}{20}$—$\frac{1}{25}$-inch = high power, all of which are but expressions for intrinsic focal distance; a 1-inch objective, hence, has the same magnifying power as a simple lens with 1-inch focus, etc. The strength is inversely as these figures—smaller the fraction the greater the magnifying power, also smaller the end lens the greater the power; whereas working-distance, field of view, and amount of light are all directly as these figures—becoming less as the fraction diminishes. Objectives of low power, 2–1-inch, serve best for pharmacists, as these afford good working distance, hence the inspection of most objects without risk of injuring the lower lens.

Fig. 486.



Objective nose-piece.

The following table shows approximate magnifying powers of oculars and objectives taken conjointly under the indicated combinations:

Oculars.	Objectives.												
	3 in.	2 in.	1½ in.	1 in.	⅔ in.	½ in.	⅓ in.	⅖ in.	⅜ in.	½ in.	$\frac{1}{10}$ in.	$\frac{1}{12}$ in.	$\frac{1}{18}$ in.
A—2 inch.	11	16	23	30	55	88	190	230	265	345	382	580	820
B—1½ "	16	22	33	41	74	120	260	315	340	460	525	810	1100
C—1 "	21	30	44	53	96	155	355	410	450	590	701	1060	1420
D—¼ "	28	40	56	69	130	200	455	550	585	770	900	1400	1860
E—½ "	35	54	70	85	165	265	560	710	750	980	1110	1760	2350

This compilation is based upon tube length being 160 Mm.—6$\frac{3}{10}$ inches; for instruments whose tube length is 216 Mm.—8½ inches—an increase of about 25 p. c. must be added in each case.

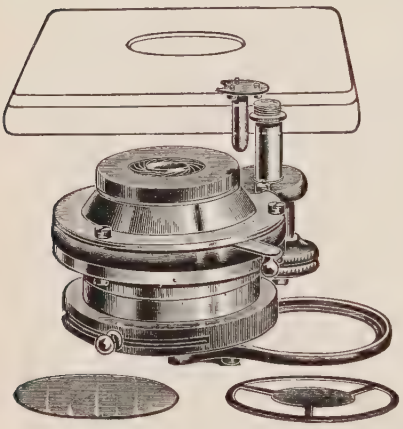
Several higher objectives are made $\frac{1}{40}$—$\frac{1}{50}$—$\frac{1}{80}$-inch, which magnify 2,000–5,000 diameters according to ocular used. These all contain, in addition to the 2–4 lenses for magnifying, a combination of lenses for correcting chromatic and spherical aberrations, the most of which, however, is compensated for by the opposite aberration of the ocular.

Chromatic Aberration.—The lens proper is not only a magnifier, but also a prism; owing to this latter fact a ray of light in passing through it is deflected from its course and resolved into its elementary colors, thus giving, unless rectified, colored marginal bands around the image of the objects examined. This chromatic defect is overcome satisfactorily by a combination of lenses having opposite aberrations, namely, a con-

vex crown lens and a concave flint lens, acting together as a single convex lens.

Spherical Aberration.—The convex lens, being in the nature of a prism, refracts rays of light toward the axis of the lens, but as the angle of the lens is greatest at the edge and gradually diminishes toward the centre, where the faces are parallel, the rays of light going through the edge of the lens are refracted more and come to a focus nearer the centre of the lens; hence there is a want of focus of the rays, or spherical aberration. This defect interferes with the defining power—*i. e.*, the definition of the image—the image of a flat object becoming curved and blurred around its edges, so that in examining netted fabrics the central fibres are straight and distinct, the outer curved and indistinct. This spherical defect may be corrected by a diaphragm which cuts off border light by contracting the central aperture.

FIG. 487.



Screw substage.

3. *The Body* (D).—This consists of the two long telescoping tubes: the outer—the sleeve; the inner—the draw-tube. To the upper end of the body (draw-tube) is attached the ocular, to the lower end the objective.

4. *The Stand* (A, B, C, etc.).—This is all the remaining portion of the instrument, and its various parts have received distinctive names, thus: A, base or foot—variously shaped (triangular, horseshoe, or circular), and sufficiently heavy to insure steadiness; B, pillar—portion above and below the stage, often jointed; C, arm; E, nose-piece—double, triple, or quadruple, into which several objectives are screwed, so that by turning either may be brought into visual position; F, objective; G, ocular; H, draw-tube; I, collar; J, rack and pinion; K, coarse adjustment; L, fine adjustment, both worked by a milled screw; M, stage; N, spring clips; O, mirror—with concave and plane surfaces, the former being used mostly; Q, diaphragm and substage; R, substage screw; S, stage aperture and substage; V, Abbé condenser—gives more light to objective, being of special service when examining stained specimens, which are recognized chiefly by color and not by outline.

II. REQUISITES OF A GOOD MICROSCOPE.

Almost any make of high-grade instrument will give satisfaction that has the following qualities:

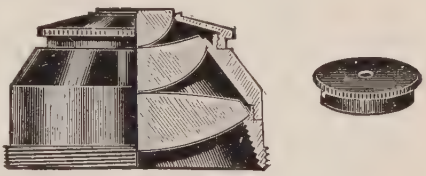
1. It should possess firmness and solidity through its base, pillar, arm, etc.

2. It should have a good-sized stage, preferably square, thick, firm, of glass, metal, or vulcanite.

3. It should have coarse and fine adjustments, worked by rack and pinion; both should move evenly, smoothly, promptly, without wobbling.

4. It should possess working distance; thus the higher objective when in focus should leave sufficient space above the stage for the introduction of slides, etc., without danger of contact. The longer the working distance, the less will the distinctness of the image formed be affected by any given alteration in its focal adjustment. Lenses with greatest working distance have most focal depth.

FIG. 488

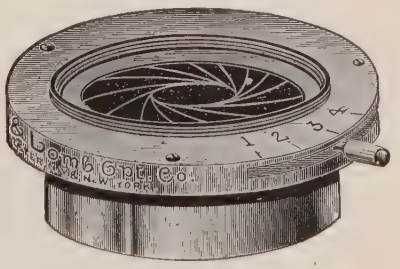


Abbé condenser.

5. A nose-piece is essential in order to economize time and facilitate work. This may be either double, triple, or quadruple, and is an appliance fitting the tube's extremity for carrying 2, 3, or 4 objectives, of varying power, any one of which may quickly be brought into direct position by turning the arm on a pivot.

6. The penetrating power (focal depth or range of focus) should be considerable. This quality, though not necessary for very thin sections, enables one to see the parts of an object not exactly in focus with sufficient distinctness to allow their relations with what lies exactly in that plane to be clearly traced out. Thus one lens may only for an instant give a sharp focus at a limited distance from the object, while another lens may give a good image at a considerable distance above and below the best focal point; the first kind of lens prevents us from ascertaining the relation of the higher layers of an object to the lower unless we continually follow the focus with the fine adjustment; the second kind of lens, having greater penetration, brings a thicker portion of the object into view at the same time—the greater the penetrating power, the better the microscope.

FIG. 489.



Iris diaphragm.

7. Flatness of the field varies with the magnifying power and angle of aperture of the lens. Here all parts of the field are in focus at the same time, so that the image is distinct over the whole field at once without marginal color. This requisite should be tested for under an eye-piece giving a large aperture.

8. The distinctness of the image (defining power) should be good;

this depends upon the complete correction of chromatic and spherical aberrations, and upon the accurate centering of the lenses, otherwise the outer borders will be blurred.

9. Resolving power, by which very minute and closely approximated markings, lines, striæ, dots, and apertures can be discerned separately; the maximum capacity thus far attained being the separation of 118,000 lines per linear inch. These three last qualities are very essential.

III. Directions for Using the Microscope.

1. For working, select a northern window; this insures the greatest amount of reflected light possible from white clouds. Never use direct sunlight, and if possible avoid artificial light. If southern exposure alone is available, have window-blind, and that well drawn.

2. The instrument should be placed between the operator and the window, and, all working parts being in order, the mirror and lens to be used should be wiped with soft chamois leather.

3. The body of the microscope should be about vertical, so as not to interfere with mounting in fluid media; the mirror should be adjusted to reflect light through the instrument, using plane side for parallel rays and concave side for divergent rays.

4. Having inserted objectives into the nose-piece, place object for examination in the centre of the slide under the cover-glass, and this as near the middle of the stage as possible; adjust light by mirror and diaphragm, and focus with coarse adjustment.

5. Make all first examinations with low power and large diaphragm aperture, at least the one yielding distinct vision; then follow with higher powers and smaller apertures. The power should always be increased at the objective first, observing the following combination:

Ocular.	Objective.
2 inch	$\frac{2}{3}$ inch = low power.
2 "	$\frac{1}{3}$ " = medium power.
$1\frac{1}{2}$ "	$\frac{1}{6}$ " = high power.

6. Hold and adjust slides with thumb and forefinger of left hand; manipulate coarse and fine adjustments with right hand.

7. To focus, turn the objective down toward slide by means of coarse adjustment, short of contact; then with eye over the ocular focus backward until object is in view; from this point the exact focus can be made by one turn of the fine adjustment. With high powers focus in the same way, never allowing lower end lens of objective to come in contact with cover-glass or any liquid, as such carelessness usually results in injury to object and objective. When properly focused, work fine adjustment slightly forward and backward during observations, to get a series of optical sections of the object; also move slide on stage to bring in view different parts.

8. Never lift slides from stage, but gently slide them off without upward movement. Previous to doing this the tube should be raised out of focus, especially with high powers.

9. Accustom yourself to use both eyes indifferently, and when one is in use keep the other open—never closed; this can soon be acquired with a little practice.

10. In examining powdered specimens, a very small amount is placed upon a slide centrally, a drop of water or glycerin added with a pipette; now put over this with forceps (slantingly to avoid air-bubbles) a cover-glass, using slight pressure on it after it is in proper position, and absorb superfluous fluid with camel's-hair pencil or blotting-paper.

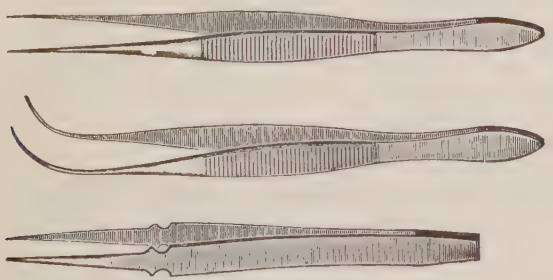
11. If specimen be tissues of which cross-sections are to be taken, use for this purpose a razor or microtome (the latter only in experienced hands). The razor should have lower surface flat, upper slightly hollow-ground; should be sharp, opened in straight line with handle, and sections made by pulling from heel to toe, using in the sliding cut considerable edge length. Both razor and object should be wet while cutting, to prevent adhesion and admission of air; if material is fresh, use for it water or diluted alcohol; if material has been hardened, employ same strength alcohol as used in the hardening process.

12. Hold objects between the forefinger and thumb, allowing the razor to rest upon the former, when the sliding cut can be made. Sections should be cut as thin as possible so as to include but one layer of cells, which proficiency can be acquired only after considerable practice. Remove sections with a camel's-hair pencil to a watch-glass containing water, and as desired arrange a section on the slide under the cover-glass with a drop of water, when it is ready for examination and the introduction of various reagents. If object be too small for such handling, it should be imbedded in some relatively hard substance—dried elder pith, cork, paraffin, etc., and then cross-sections taken as before, but through the combined mass.

IV. Accessory Apparatus and Reagents.

1. A pair of fine-pointed forceps for handling cover- and watch-glasses, small objects, etc.

Fig. 490.



Dissecting-forceps.

2. A pair of fine scissors, sharp-pointed and bent, for dividing tissues, etc.

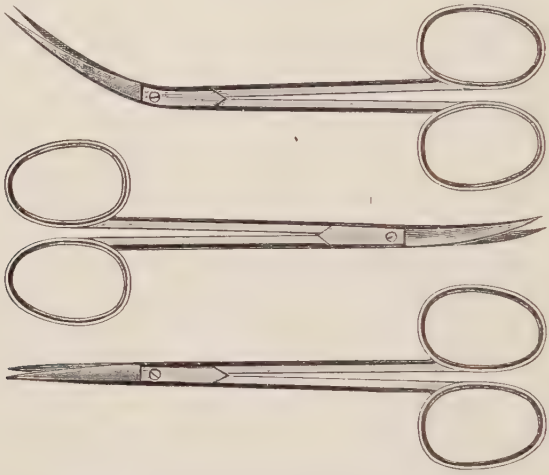
3. A pair of dissecting-needles for teasing tissues apart, etc.

4. A good razor, under side flat, upper slightly concave, edge straight, also strop and hone.

5. A supply of glass slides 3 x 1 inch, with ground edges, also cover-glasses, square or circular, $\frac{3}{4}$–$\frac{7}{8}$ inch, section-lifters, etc.

6. Watch-glasses (flat bottom) in which sections are to be bleached, stained, etc.

Fig. 491.



Dissecting-scissors.

7. Graduated ruler for drawing and estimating magnifying power.

8. Camera lucida for drawing, the Abbé being the best.

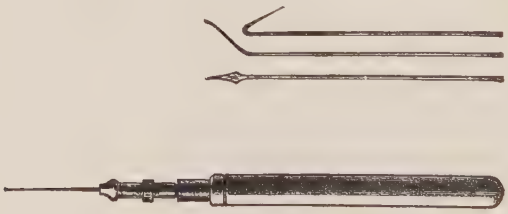
9. Spirit lamp, racks for holding slides and reagent bottles.

10. Pipettes, glass rods, camel's-hair pencils, blotting-paper, chamois.

11. Micrometer adapted either to the eye-piece or stage, or to both.

12. Turn-table with self-centering device, for mounting and finishing slides.

Fig. 492



Dissecting-needles.

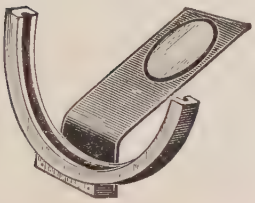
13. Caustic potash—2–5–10 p. c. solutions, used to dissolve proteids, starch, to swell cell-walls, etc.

14. Acetic acid (glacial), 1–2 p. c. solutions, for defining nucleus, clearing cell-contents, in staining, and to distinguish calcium oxalate from calcium carbonate—the latter dissolving with effervescence.

15. Sulphuric acid, 92 p. c.—dissolves starch and cellulose, converting them into dextrin and amyloid, respectively; diluted acid (10 p. c.)—serves to identify crystals in cells. Thus calcium oxalate, carbonate, phosphate, and malate, all are converted into needles of calcium sulphate, while sphere crystals of inulin, resembling calcium phosphate, are dissolved completely.

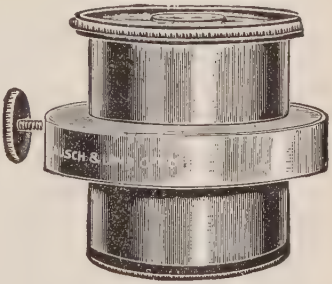
16. Hydrochloric acid—as a clearing agent, with phenol, thymol, aniline chloride, etc.; also to distinguish calcium oxalate from carbonate (dissolves latter with effervescence, the former slowly without

Fig. 493.



Camera lucida (brass mounted).

Fig. 494.



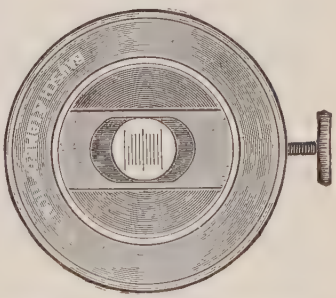
Ocular micrometer.

effervescence); also to modify overstained sections from hæmatoxylin, carmine, and aniline solutions.

17. Nitric acid, 68 p. c.—causes protoplasm to shrink from cell-wall, and when ammonia is added afterward we have the middle lamella stained yellow; a 30 p. c. solution swells and finally dissolves amyloid.

18. Chromic acid (strong solution)—separates cells of thick-walled tissue, dissolving easily the middle lamella, finally the entire cell; a $\frac{1}{2}$–1 p. c. solution fixes cell-contents of tissues by soaking in it 24 hours, then wash and stain.

Fig. 495.



Sectional view of ocular micrometer.

19. Compound iodine solution (tincture iodine + potassium iodide) stains starch blue, proteids yellowish-brown, lignified cell-walls deep brown, kills protoplasm without dissolving it, is a fixing agent, and with H_2SO_4 becomes a test for cellulose.

20. Chlor-zinc-iodine (Schulze's solution) — colors cellulose blue, lignified and cutinized tissues brown, starch is turned blue, swells and dissolves; swells cells-walls and stains protoplasmic threads brown, therefore is used in studying continuity of protoplasm from cell to cell.

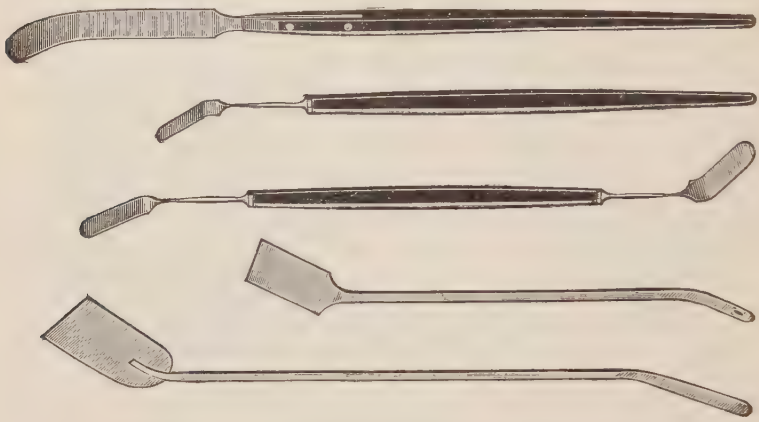
21. Aniline chloride, colorless, 5 p. c. alcoholic solution, or saturated aqueous solution + sufficient HCl to acidify—stains lignified tissues deep yellow, but does not affect cellulose and cutinized tissues.

22. Fehling's solution—with grape-sugar a red color is obtained. If cane-sugar be present, a bluish or greenish color appears.

23. Ammonio-ferric alum—with tissues containing tannin gives bluish-black or greenish-black precipitate.

24. Silver nitrate, 2–3 p. c. solution—develops the laminæ in starch-grains and in thick-walled cells.

FIG. 496.



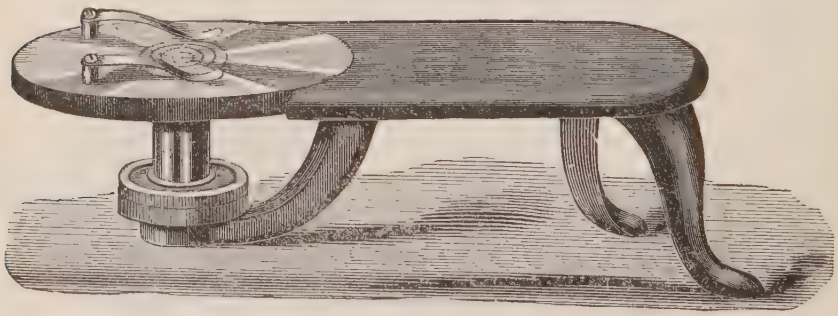
Section-lifters.

25. Diphenylamine solution—turns tissues blue that contain nitrates.

26. Ether—dissolves out oils, resins, fats, etc.

27. Alcohol—preserves tissue, dissolves chlorophyll, coloring-agents, resins, oils; also bleaches.

FIG. 497.



Turn-table.

28. Phenol (carbolic acid)—useful clearing agent, can mount directly from this solution.

29. Glycerin—for clearing sections, preserving tissues for temporary or permanent mounting.

30. Canada balsam—for permanent mounting.

V. Some Advanced Microscopic Methods and Appliances.

1. *Estimation of Magnifying Power.*—While the table given on page 899 is of interest and service, yet, owing to slight variations therefrom in almost every microscope, each operator always prefers to test his own by one or all of the following methods:

(*a*) By taking absolute measurements. Ten inches are recognized generally as the normal length of distinct vision with the naked eye. Now, suppose the distance from an object in focus to the upper end of ocular is 10 inches, and that the 2-inch ocular and 1-inch objective are in service, we will then have the ocular focusing at 2 inches what the eye does in 10, or it magnifies 5 diameters—$10 \div 2 = 5$; also the objective focusing at 1 inch what the eye does in 10, or it magnifies 10 diameters—$10 \div 1 = 10$; consequently these two combined—$5 \times 10 = 50$, which is the total magnification of the instrument as arranged. If we use 1-inch ocular and $\frac{1}{5}$ objective, we have $10 \div 1 = 10 =$ magnification of ocular alone; $10 \div \frac{1}{5} = 50 =$ magnification of objective alone; hence the two combined—$10 \times 50 = 500$ diameters = combined magnification.

(*b*) By a stage micrometer and a 2-inch boxwood rule. This micrometer is but a glass slide having 1,000 ruled lines to the inch. When this is focused and the rule placed in front of and parallel with it on the stage, we can compare the two simultaneously by looking at the micrometer through the microscope with one eye and at the ruler with the naked eye. If the micrometer spaces now appear $\frac{1}{2}$ inch apart, the magnifying power is 500 diameters; if 1 inch apart, then 1,000 diameters.

(*c*) By stage micrometer and camera lucida. This gives greater accuracy, and is accomplished by focusing stage micrometer and placing a camera lucida on the eye-piece. To one side in same plane as stage place a sheet of white paper at right angles to the object viewed, and upon this will be projected the image of the lines, which then can easily be drawn and the distance between any two measured. Suppose they are $\frac{1}{5}$ inch apart; now those on micrometer are $\frac{1}{1000}$ inch apart, hence magnifying power is 200 diameters—$\frac{1}{5} \div \frac{1}{1000} = \frac{5}{1000} = 200$. Instead of the camera lucida, an eye-piece micrometer in conjunction with the stage micrometer can also be used with equal if not better results.

2. *Hardening.*—If tissues to be examined are not sufficiently firm to allow satisfactory cutting—as tender parenchyma of non-vascular plants, they should be hardened by soaking several hours in diluted alcohol, then in pure alcohol. The employment of several alcohols varying in strength prevents tissue-contraction by osmotic action. Alcohol here dissolves resins, volatile oils, chlorophyll, thus acting as a bleaching agent. It coagulates and kills protoplasm without impairing its structure, also renders it more opaque, when it may readily be stained with the various fluids; it also dehydrates tissues previous to being mounted in Canada balsam.

3. *Softening.*—All dry and hard substances should be softened before sections can be made properly. In the case of roots, rhizomes, tubers, corms, fruits, seeds, etc., they are soaked first in alcohol half an hour to expel air, then in water several hours or until saturated (hard tissues, shells, etc., may require several days); if now too soft for cutting, lay in alcohol 24 hours; if again too hard or brittle, place in a mixture of equal parts of alcohol and glycerin for 24 hours. In such roots as gentian, etc., that are much shrunken, we should use for water in second stage a 1–2 p. c. aqueous solution of potassium hydroxide or ammonia; this alkali, however, should always be washed out with water before hardening. Specimens thus prepared can be kept always in readiness by letting them remain immersed in a mixture of equal quantities of alcohol and glycerin.

4. *Clearing.*—It is often necessary to clarify sections by having absorbed from them such substances as would prevent transparency—starch, resins, oils, etc. To accomplish this, sections should be boiled in water and put into diluted Labarraque's solution for 15 minutes, or placed for a short while into a mixture of 4 parts oil of turpentine + 1 of creosote, or into pure oil of cloves, then mounted in Canada balsam. When sections have been stained, should soak them first in alcohol for a few minutes and then in the clearing-mixture.

5. *Staining Fluids.*—These make prominent and differentiate thin cell-walls, inconspicuous and uniform tissues, etc., thus making their differences in appearance very perceptible.

(*a*) Hæmatoxylin. Prepared by mixing 2 parts saturated alcoholic solution hæmatoxylin with 75 parts saturated aqueous solution ammonia alum; let stand a week in sunlight, filter, and to every 7 parts add 1 part each of glycerin and methyl alcohol, allow sediment to deposit by standing, filter. Used to stain lignified and cellulose walls—not cutinized ones; is also a good nuclear stain. Sections should soak several hours—those from alcohol should first be washed and all acids avoided.

(*b*) Fuchsin. A solution of fuchsin in water, used to stain lignified cell-walls, as these hold color better than non-lignified ones. When sections with fuchsin staining are washed with a mixture of saturated solution of picric acid 1 part + water 2 parts, the fuchsin is removed from unlignified cell-walls, while lignified ones remain beautifully stained. These may now be dehydrated and mounted, or double-stained with aniline blue, then dehydrated and mounted.

(*c*) Methyl-green. An aqueous solution of methyl-green sufficiently strong to give deep green color. It stains protoplasm, nucleus, also lignified and cutinized tissues better than it does cellulose. Tissues absorb color quicker if previously washed in weak acidified (HNO_3) water.

(*d*) Iodine-green. Made by dissolving iodine-green in water until a deep green solution results. This stains lignified and cutinized tissues green, also proteids, amyloplasts attached to young starch-grains; acts on cellulose tissues slightly. Often used with carmine, eosin, or fuchsin for double staining.

6. *Mounting.*—When for only temporary or immediate use, water or glycerin, or a mixture of the two, is employed. If it is to be permanent, then Canada balsam is the best medium. Mounting is accomplished thus: The sections, if stained in aqueous solution, should first be dehydrated by placing for a few minutes in 70 p. c. alcohol, then in 90 p. c., and finally in 98 p. c.; now put for a short while in clearing medium—oil of cloves or oil of turpentine—place a section on centre of slide, add to it a drop of balsam, apply cover-glass slantingly to avoid air-bubbles, slightly tapping same to a fixed position. If just sufficient balsam is used, we have simply to let it dry several days, then ring with a circle of colored cement around marginal contact of cover-glass with slide.

VI. The Microscope in the Drug-store.

While it is true that many official drugs come to us with adulterations and sophistications, yet in order to identify such with the microscope one should be perfectly familiar with the appearance of the pure drug. In order to be certain of reliable results, he should examine at least a dozen samples taken from various portions of the substance in question. In examining cross-sections of drugs in their original entire form we should know the arrangement as well as character of all the composing tissues, by which alone identification and recognition can be assured. In examining powders we have the most difficulty, as quite all the original characteristics are much changed or destroyed by comminution. Here, however, a sample of the crude article as powdered by one's self is to be compared with the specimen under consideration. Should the direct observance of a powder through the various objectives give little satisfaction, then micro-chemical reagents can, in regular sequence, be added with, as a rule, good results. By an examination with the microscope alone we can recognize readily the border-pits, so characteristic of gymnospermous plants (savin, etc.), when mixed with angiospermous powders. Again, a powder may contain, as a natural constituent, the very thing with which it is adulterated mostly (starch in black pepper, etc.); in all such cases the abnormal quantity present will show conclusively the fraudulent addition; again, resins, oil-globules, crystals, starch, etc., may be observed as present, and yet not a true constituent; such should excite suspicion and lead to application of further specific tests; again, the kind of delicate hairs as characteristic of certain plants can often be recognized whole or in part —unicellular or multicellular; the thickness and appearance of varying cell-walls; the individual variety of tissue, etc., often will aid also in the identification. The elementary components and contents of plant-tissues to be looked for are fragments of ducts, bast-cells, characteristic epidermal and stone-cells, cork, plant-hairs, glands, calcium oxalate crystals, starch, etc. The articles employed for adulterating, such as are known likely to occur in respective drugs should be studied separately, so that when encountered where not belonging they can easily

be identified. Such adulterants may consist of mineral matter, as calcium sulphate, calcium carbonate, iron carbonate, iron oxide, clay, brick, sand, sawdust, starch, flour, rosin, wood, bark, seeds, beans, peas, leather, cocoanut shells, exhausted and injured drugs, etc.

The following samples are but a few of the very many which any druggist may experiment with to his satisfaction and advantage.

I. Roots. 1. *Senega from False Senega.*—Soak suspected root in water until soft (10 hours), make thin cross-sections: true senega root has irregular, porous, yellowish wood; false senega root has cylindrical, porous, whitish wood. The irregularity of the structure of the cortex of senega (true) is well brought out by staining with hæmatoxylin solution. See pages 369, 372.

2. *Taraxacum from Chicory.*—Make thin cross-sections as before: taxaracum shows in the bark laticiferous ducts in many brown circles; chicory has these vessels arranged radially. The location of the laticiferous ducts is revealed readily by staining with hæmatoxylin, as they assume a darker color than the other cells on account of the dense coagulated contents of the duct. Both have deposits of inulin (which is related closely to starch) in the soft cells, which stains yellow with iodine. See pages 612, 613.

3. *Calumba from Bryonia.*—Calumba shows thick bark, small wood-bundles bright yellow, distant near the centre, in narrow rays near the bark, medullary rays broad, parenchyma filled with starch; bryonia has thin bark, cork thin, friable, wood-bundles small, numerous, in rays and concentric circles, surrounded by thin-walled parenchyma. See pages 215, 599.

4. *Belladonna from Inula.*—Belladonna has thickish bark, no bast-fibres, wood-bundles central, small, distinct, surrounded in the thicker roots by broader wood-wedges, and equally wide medullary rays; inula has a broad bark of small cells, radially arranged, with a distinct light circle of cambium between the bark and the wood area, which latter is made up of a large proportion of soft cells radially arranged and many large wood-vessels in rows. Both in the bark and the wood area there are many large openings of resin-ducts. Inula contains inulin deposited as spheres in the cells, while belladonna has much starch over the whole section. See pages 533, 616.

5. *Ipecac from Spurious Ipecacs.*—Ipecac has quite a regular bark of isodiametric cells containing starch; some of the cells contain oxalate raphides (needles), particularly in the inner bark. The wood is radiate, with medullary rays hardly distinguishable from the wood-cells in shape, but containing starch-grains. False roots have thick bark, no starch. See pages 584, 590.

6. *Pareira from False Pareiras.*—Pareira has thin bark, wood in several concentric circles, waxy cut, wood-wedges porous, uniform, numerous, separated by wavy circles of waxy parenchyma-tissue resembling medullary rays, stem with central pith. False roots have hard wood in eccentric circles, fresh cut not waxy. See pages 219, 221.

II. Rhizomes. 1. *Veratrum Viride from Cypripedium.*—Veratrum viride has one-seventh diameter in cortex consisting of parenchyma having starch, sometimes calcium oxalate, few wood-bundles, one-eighth inch from outside has brownish wavy nucleus-sheath, centre with many wood-bundles; cypripedium has thick cortex, indistinct nucleus-sheath, wood-bundles approximate, more distinct centrally, parenchyma has starch. See pages 102, 143.

2. *Arnica from Strawberry.*—Arnica has thick bark, thin cork, circle of resin-cells, wood-wedges in a close circle enclosing large pith; strawberry rhizome has no resin-cells, but contains starch. See page 619.

3. *Serpentaria from Spigelia.*—Serpentaria has thin bark containing some oil-cells, wood-wedges longest on under side, separated by broad medullary rays, pith large-celled; spigelia has thin bark, divided into two distinct layers, an inner third and outer two-thirds; wood-circle thickest on under side, radiate, continuous except usually at one end where wood is missing, medullary rays hardly visible. Pith oval and sometimes decayed; resin-spots in wood, especially around pith. See pages 175, 486.

4. *Hydrastis from Caulophyllum.*—Hydrastis has thick bark, broad wood-wedges, not fixed in number (often 10), decidedly yellow; medullary rays broad, yellow, pith large, both, like the bark, contain starch; caulophyllum has thin bark, wood-wedges not so long as in hydrastis, medullary rays broad, pith large, parenchyma contains starch. See pages 194, 214.

5. *Helleborus Niger from Helleborus Viridis.*—Helleborus niger has bark thick, circle of 8 wood-wedges, broad medullary rays, pith large; helleborus viridis has circle of 4 wood-wedges, broad medullary rays. See pages 199, 200.

III. Woods. 1. *Guaiacum from Santalum Album.*—Guaiacum consists mostly of wavy interwoven wood-fibres, numerous 1-rowed medullary rays, large single ducts and narrow lines of wood, parenchyma in 1–2 rows of irregular and interrupted circles—all cells contain resin; santalum album has ducts single, moderate size, wood-parenchyma narrow, contains volatile oil or calcium oxalate, medullary rays narrow, in 1–2 rows. See pages 172, 340.

2. *Santalum Rubrum from Hæmatoxylon.*—Santalum rubrum has large ducts, 1-rowed medullary rays, wood-parenchyma 4-rowed in interrupted, irregular circles, cells with red resinous coloring matter, parenchyma with calcium oxalate crystals; hæmatoxylon has large ducts, often in groups of 2, medullary rays 2-rowed, wood-parenchyma in broad, wavy, circular lines, coloring matter in wood-fibres and ducts. See pages 302, 319.

IV. Barks. 1. *Cinchona Calisaya from Cinchona Succirubra.*—Cinchona Calisaya has very few, if any, stone- (resin-) cells, old bark with prominent secondary cork, medullary rays narrow, bast-fibres single, sometimes in groups of 2, rarely more, medium sized; cinchona suc-

cirubra has no stone-cells, medullary rays narrow, bast-fibers medium, in lines 2 to 5, seldom 8. See pages 561, 562.

2. *Quillaja from Ulmus.*—Quillaja has crystals of calcium oxalate on the cross-section or on the broken splintery fracture, also starch-grains; slippery elm has fracture fibrous mealy, very little starch, but no calcium oxalate. See pages 164, 268.

V. Fruits. 1. *Anise from Conium.*—Anise has flat face, 5 light brown filiform ridges, also 15 or more thin oil tubes; conium has 5 crenate ribs but no oil tubes. See pages 438, 443.

2. *Fennel from Caraway.*—Fennel has 5 obtuse, conspicuous ribs, 4 oil tubes on back, 2–4 on flat face; caraway has 5 filiform ribs, 6 oil tubes. See pages 441, 446.

VI. Seeds. *Stramonium from Black Mustard and Colchicum.*—Stramonium has albumin whitish, oily, enclosing cylindrical embryo, curved parallel with edge of seed; mustard has oily embryo, radicle curved, 2 cotyledons, one folded over the other; colchicum has albumin oily, horny, tough, enclosing small embryo opposite hilum, monocotyledonous. See pages 107, 252, 548.

VII. Powders. 1. *Starches.*—Each starch has a characteristic-sized-and-shaped granule dependent upon its source. As these, therefore, all differ, we have only to take several $\frac{1}{4}$ gr. (.016 Gm.) samples of a specimen and add to each a drop of water on a slide under a cover-glass —with $\frac{1}{5}$-inch objective we can recognize readily the predominating starch and identify all possible starchy adulterations: corn-starch (*U.S.P.*, pages 87, 90) is mostly in pentagons and hexagons; rice-starch (page 90) similar, but only one-fifth size; wheat-starch (page 90), lenticular layer indistinct, hilum central, third larger than corn-starch; also notice starches of maranta (pages 90, 138), canna (page 138), curcuma (pages 90, 134), sago (pages 91, 100), ginger (page 132), cassava (pages 90, 384). All starches turn blue with iodine and swell with potassium hydroxide solution or diluted sulphuric acid.

2. *Ginger from Corn- and Wheat-starch.*—Ginger contains normally about 20 p. c. of its own peculiar starch, whose granules are flat and broadly ovate, but when seen edgewise look long and narrow, with small hilum near narrow end, marked by many transverse lines. Resemble but are smaller than granules of E. India arrowroot; corn- and wheat-starch added increase the amount beyond 20 p. c., and can be recognized by their characteristic shapes. See pages 90, 132.

3. *Clove from Powdered Shells and Starch.*—Clove is very simple, consisting of fragments of parenchyma-cells, having thin walls and a faint yellow color; a few long, stout, colorless bast-fibers and some small spiral vessels; no starch; shells consist of thick-walled stone-cells, lignified, with pore-canals, etc. See pages 90, 424.

4. *Taraxacum from Chicory.*—Taraxacum consists of clear white fragments of parenchyma-cells, with occasional large vessels approaching the scalariform in type; chicory is similar to taraxacum, except that the vessels are slightly smaller and more reticulate. Some latex tubes may also be seen. See pages 612, 613.

5. *Digitalis from Senna.*—Digitalis has numerous multicellular hairs, which, having constrictions, appear to be formed of a number of elongated cells; senna, on the contrary, has many unicellular hairs having thick and rough cell-walls. See pages 292, 553.

6. *Stramonium from Tobacco.*—Stramonium has multicellular hairs somewhat resembling digitalis, while tobacco also has multicellular hairs, some having glands at their free extremities. See pages 548, 551.

7. *Kamala from Lupulin.*—Kamala consists of stellately arranged, colorless hairs mixed with depressed globular glands, containing 40–60 club-shaped vesicles; lupulin consists of minute granules, subglobular or hood-shaped, reticulate, lower half obtusely conical. See pages 169, 376.

8. *Lycopodium from Pine-pollen.*—Lycopodium consists of granules that are tetrahedral, reticulated, rounded on one side and on the edge, with short projections; pine-pollen consists of an elliptic cells, at each end of which is attached a globular cell. See pages 71, 72.

APPENDIX.

POISONS—TREATMENT AND ANTIDOTES.

Poisoning may be of two kinds: 1. Chronic, where small doses are repeated at more or less short intervals, thereby slowly establishing characteristic symptoms (arsenic, bromides, iodides, lead, etc.). A few drugs have been termed "criminal poisons," because when thus given they produce effects partly imitative of certain diseases, hence preclude ready conviction of the guilty (arsenic, colchicum, tartar emetic, etc.). 2. Acute, where a single excessive dose is taken, which quickly produces alarming conditions, and it is this phase of the subject that should be understood as here considered.

Some poisons produce specific symptoms that are recognized and treated easily, others have more complex action that require a general treatment. Nearly all give evidence of gradual ingestion within 15–30 minutes, while a few, being absorbed very quickly, show effect almost immediately (hydrocyanic acid, strychnine, nicotine, reptile-venom, gases, etc.). All demand prompt medication and imply doubtful recovery, consequently, owing to the greatest possible haste being necessary, both physicians and pharmacists should consider it imperative to have always in mind the respective treatment and at command the many combating remedies. These are called: 1, *antidotes* that act either (*a*) mechanically—by simply protecting the stomach walls from the poison (starch, flour, oil, demulcents, etc.), or (*b*) chemically—by combining to form less soluble and active compounds in the stomach (tannin, sodium sulphate, magnesium sulphate, lime water, magnesium oxide, etc.); 2, *antagonists*, that act (*c*) physiologically—by neutralizing or counteracting the action of the drug after it enters circulation (atropine—morphine; aconite—digitalis, etc.).

Rationale of Treatment.

Excessive quantities of poisons frequently from the first cause free vomiting and purging *per se*, thereby largely correcting their evil effects, but when neither of these occurs, vomiting should at once be induced by either zinc sulphate, mustard, pump, apomorphine, etc.; next administer the proper chemical antidote (if one exists), or physiological antagonists (incompatibles), awaiting thereafter 15 minutes; now produce emesis, and wash out stomach with warm or warm-medicated water; finally treat functional and organic symptoms (respiration, circulation, temperature) that may necessarily arise. In depressing poisons, as well as corrosive substances, emetics should be used cautiously, lest by wrenching we occasion greater exhaustion and

possibly a rupture of the impaired stomach-wall; here the pump or siphon-tube is to be preferred. The bladder should be emptied frequently, if necessary by catheter, and in many cases a quick-acting cathartic is of considerable advantage. Diffusible (cardiac) stimulants, artificial respiration, electricity, artificial heat, etc., are all at times of great service.

While it is true that the majority of poisons demand specific and different treatment, yet for simplicity sake a few groups can be formed, each containing drugs amenable to like antagonism, thus—alkalies and alkaline salts are combated with weak acids, albumen, demulcents; acids and acid salts with weak alkaline solutions, albumen, demulcents, oil; alkaloidal drugs with tannin, coffee, tea; depressants with stimulants and *vice versa*, etc.

Usual Agents Employed in Poison Cases.

1. *Jeaunel's General Antidote.*—Either of the following formulas may be employed when the nature of the poison is doubtful, or for arsenic, digitalis, mercuric salts, opium, strychnine, and zinc salts, but is of no value for antimony compounds, caustic alkalies, or phosphorus:

℞.	Liquor Ferri Tersulphatis,	ʒiiss	(75 cc.)
	Magnesii Oxidum,	ʒij	(60 Gm.)
	Carbo Animalis,	ʒj	(30 Gm.)
	Aqua Fontana,	ʒxx	(600 cc.). M.

Keep the three last ingredients always mixed, and add liquor when needed. Dose, ʒij–3 (60–90 cc.).

℞.	Magnesii Oxidum,	ʒij	(60 Gm.)
	Carbo Ligni,	ʒij	(60 Gm.)
	Ferri Hydroxidum,	ʒij	(60 Gm.)
	Aqua Fontana,	ʒxij	(360 cc.). M.

Dose, *ad libitum.*

"Universal Antidote."

℞.	Carbo Ligni,	ʒij	(60 Gm.)
	Acidum Tannici,	ʒj	(30 Gm.)
	Magnesii Oxidum,	ʒj	(30 Gm.). M.

Dose, teaspoonful in glass of water—repeat in 15–20 minutes if necessary.

2. *Albumen, White of Egg.*—Dissolve 4 egg-whites in a quart of warm water—for mineral acids, mineral salts (corrosive sublimate, etc.), corrosive alkalies, aniline, creosote, bromine, chlorine, iodine, etc.

3. *Milk, Fatty Oils, Mucilaginous Substances.*—Substitute for albumen—for corrosive salts, corrosive acids and alkalies (especially ammonia), but the first two never for cantharides (phenol—carbolic acid), copper salts, or phosphorus, whose absorption they promote.

4. *Castile Soap.*—Dissolve in 4 volumes of water, as a substitute for albumen—for corrosive acids, metallic salts (corrosive sublimate, potassium dichromate, tin and zinc salts), corrosive vegetable substances; harmful in alkaline poisoning, hence not to be used. Dose, ʒij–12 (60–360 cc.).

5. *Tannic Acid, Coffee, Tea.*—To precipitate the various alkaloids as insoluble tannates; *Potassium Permanganate*—for morphine,

codeine, etc.; *Dialyzed Iron*—for arsenic; *French (Old) Oil of Turpentine*—as chemical antidote for phosphorus; *Ammonia Water, Aromatic Spirit of Ammonia, Brandy, Whisky, Amyl Nitrite, Faradic Battery, etc.*—for general stimulation.

6. *Vinegar, Diluted Mineral Acids.*—To neutralize alkalies and alkaline salts; *Magnesium Oxide, Sodium Bicarbonate, Calcium Carbonate, Sodium and Magnesium Sulphates*—for various acids and acid salts; *Charcoal,* animal and vegetable—for arsenic, corrosive sublimate, etc.; *Chloral Hydrate, Chloroform, Ether, Potassium Bromide*—as narcotics or anesthetics in tetanic poisoning.

7. *Emetics:* (1) Zinc Sulphate, gr. 5–15 (.3–1 Gm.), repeated twice if necessary, at 15-minute intervals, or until emesis is produced; (2) Mustard, ʒj–4 (4–15 Gm.), stirred to a cream with water; (3) Ipecac, gr. 15 (1 Gm.), repeated if necessary in 15 minutes; Apomorphine Hydrochloride, 2 p. c. solution, ♏iij–5 (.2–.3 cc.) hypodermically); Stomach-pump, or Rubber Tubing (5–8 feet of ½ inch); Tartar Emetic, gr. ½ (.03 Gm.) in sweetened water, for children.

8. *Hypodermic Solutions:* (1) Atrophine Sulphate, 1 p. c., ♏ij–6 (.13–.4 cc.)—as physiological antidote for aconite, benzene, gelsemium, morphine, muscarine, opium, physostigmine, pilocarpine, etc.; (2) Pilocarpine Nitrate, 5 p. c., ♏x–15 (.6–1 cc.)—as physiological antidote for atropine, scopolamine, daturine, duboisine, hyoscyamine, etc.; (3) Morphine Sulphate, 10 p. c., ♏v–8 (.3–.5 cc.)—for similar use as pilocarpine nitrate; (4) Strychnine Sulphate or Nitrate, 2 p. c., ♏ij–3 (.13–.2 cc.)—as physiological antidote for most depressants: acetanilid, aconite, chloral hydrate, chloroform, conium, physostigmine. All of these should be used in an aseptic hypodermic syringe.

For specific poisoning the following treatments are recommended:

Acetanilid, Antifebrin, Antipyrine, Phenacetin: Empty stomach, place in recumbent position, supply abundant fresh air or oxygen (for cyanosis, loosen clothing around neck, chest, and waist), stimulants (brandy, whisky, ammonia), external heat, atropine or belladonna (to maintain blood-pressure), strychnine to aid respiration.

Acids: If these have been taken in concentrated form, it is unwise to give emetics or use the pump, as either might tend to lacerate the softened esophagus.

1. *Chromic, Potassium Chromate and Dichromate:* Emetics, magnesium oxide, carbonate, sodium bicarbonate, borate, chalk in water to a paste, demulcent drinks (flaxseed, elm, etc.), stimulant enemas.

2. *Hydrocyanic—Cyanides, Oil of Bitter Almond, Cherry Laurel Water:* Recumbent position, abundant fresh air, oxygen, smell chlorine water or diluted chlorine gas, vomit, hypodermic atropine for heart, brandy, ether, ammonia inhalations; if breathing ceases, use artificial respiration, mild faradic current to the heart, alternate cold and warm affusions to head, chest, and spine; ferrous and ferric sulphates followed by potassium carbonate solution yield insoluble Prussian blue (antidote), ferrous sulphate alone or with magnesium oxide renders acid insoluble, but the action of the acid is so quick that, as a rule, anti-

dotes avail little; ♏xv (1 cc.) of 2 p. c. acid, or gr. 1 (.06 Gm.) of anhydrous acid, usually is fatal in 15 minutes.

3. *Mineral—Hydrochloric, Nitric, Nitrohydrochloric, Sulphuric, Phosphoric, Glacial Acetic:* Neutralize with an alkaline solution—sodium, potassium, magnesium carbonate or bicarbonate, magnesium oxide, lime, chalk or wall-plaster (H_2SO_4), dissolved or mixed with water, soap-suds, water freely, except with sulphuric, then demulcent, drinks, gruel, egg-white, almond or olive oil, warmth and friction to extremities (feet, hands), emollient fomentations, brandy and whisky for collapse, morphine for pain.

4. *Oxalic—Oxalates, Salt of Lemon (Potassium Oxalate):* Unless poison has occasioned vomiting, empty stomach at once, then neutralize with chalk, whiting or wall-plaster in creamy paste with water, lime water, vomit to remove insoluble calcium oxalate, give demulcent drinks, oils, opium for pain, hot fomentations to abdomen, friction to extremities (feet, hands), enema, much water to hasten elimination by kidneys; avoid potassium and sodium (alkaline) carbonates, which form soluble oxalates; ʒss–1 (15–30 Gm.) usually proves fatal.

Aconite, Aconitine, Pulsatilla: Evacuate and wash out well the stomach, unless symptoms severe, when vomiting should be avoided, if possible, and then in a towel without raising head; place in recumbent position, with absolute quietness, feet elevated (to confine circulation to vital centers at base of brain), dry warmth to body, especially extremities (feet, hands), cardiac (diffusible) stimulants (brandy, whisky, alcohol, ether, ammonia) by mouth or skin, digitalis for heart syncope (tincture ♏xxx; 2 cc.), hypodermic atropine, 1 p. c. sol., (♏iv; .26 cc.) or strychnine (gr. $\frac{1}{20}$–$\frac{1}{10}$; .003–.006 Gm.) for cardiac and respiratory stimulation, tannin, amyl nitrite, oxygen, artificial respiration. Tincture of aconite ♏xxx–60 (2–4 cc.), and aconitine gr. $\frac{1}{20}$ (.003 Gm.), have each proved fatal.

Alcohol, Alcoholism, Delirium Tremens: Drunkenness resembles somewhat opium poisoning and brain concussion. Empty stomach, washing it out well with strong warm coffee, apply warmth to body and extremities (feet, hands), cold douche to head, plenty fresh air, interrupted current to respiratory muscles, inhale ammonia, amyl nitrite, artificial respiration, keep awake mechanically.

Alkalies, Potassium and Sodium Hydroxide, Ammonia, Spirit of Hartshorn, Ammonia Smelling-salts, Carbonates: Neutralize with vinegar, lemon-juice, diluted acetic acid, then give demulcent drinks, fatty oils, opium to relieve pain. For ammonia gas inhale warm acetic acid vapor, and lessen chest-pain by a few chloroform inhalations.

Alkaloids: Empty stomach at once, follow with tannin solution or strong coffee, tea to form insoluble tannates.

Alum: This usually vomits *per se*, otherwise give emetic, then ammonium or potassium carbonate, demulcents.

Aniline (Dyes, Ink): Vomit with copper sulphate, or wash out stomach with warm water—recumbent position, loosen clothing, abundant fresh air, oxygen, ether injections, ammonia, whisky, brandy, strychnine, magnesium oxide (gr. 30; 2 Gm.); ʒss–2 (2–8 Gm.) have been fatal.

Antimony, Chloride, Wine, Tartar Emetic: These usually vomit actively *per se;* if not should empty stomach, giving abundance of warm water, follow with tannin solution, coffee, tea, gallic acid (to form insoluble tannates), demulcent drinks, egg-white, milk, warmth, friction, faradic current over heart, opium and stimulants in small and frequent doses, artificial respiration; magnesium and sodium carbonates may be used, also ferric hydroxide followed with opium or morphine for pain; magnesium oxide in milk for the chloride; Tartar Emetic, gr. 2–5 (.13–.3 Gm.) have killed, much larger doses often have failed.

Arsenic, Paris Green, Fly-stone or -powder, Fowler's Solution, Rough on Rats, Cobalt: Produce emesis if it has not occurred, washing out the stomach with much water, then give freshly precipitated ferric hydroxide, made by double decomposition between any ferric solution well diluted, and either ammonia water well diluted, sodium carbonate, or magnesium oxide, the object being to envelop the poison mechanically and to form insoluble ferric arsenite or arsenate; usually give ʒj (4 Gm.), every 5 minutes, for 8 doses, and follow with zinc sulphate, then castor oil; may give oils, demulcent drinks, egg-white, and stimulants for faintness and great depression, warmth to body, opium or morphine for pain, poultices and fomentations to stomach, flour, lime water, dialyzed iron, subcarbonate of iron, alkaline mineral waters.

Belladonna, Scopola, Hyoscyamus, Stramonium, Duboisia, Dulcamara (Atropine, Scopolamine, Hyoscyamine, Daturine, Duboisine, Solanine): Empty stomach, give tannin solution, strong coffee, tea by mouth or rectum, hypodermic morphine, physostigmine or pilocarpine (to antagonize nervous disturbance, delirium, etc.), then diffusible stimulants (whisky, brandy, ammonia), caffeine, strychnine, cold to head, warmth and friction to extremities (feet, hands), artificial respiration.

Benzene, Nitrobenzene, Oil of Mirbane: Empty stomach, give plenty fresh air, hypodermic atropine, alternate cold and hot water douches to chest, mild faradic current over heart, artificial respiration.

Bites. 1. *Dogs, Cats:* At once suck forcibly the wound, endeavoring also by squeezing to force out all blood possible, wash with warm water, and cauterize well with lunar caustic; 2. *Snakes:* Apply cupping-glass over wound, or tie the limb moderately tight above injured spot, allow to bleed freely, aiding by pressure, wash with warm water and cleanse thoroughly, cauterize with mineral acids or phenol (carbolic acid); apply potassium permanganate solution (5–10 p. c.), ammonia water, tincture of iodine; cause perspiration by warm drinks, ammonia, wine, arsenic; one with perfect mucous surface should forcibly suck wound; if much prostration, give liberally of diffusible stimulants (whisky, brandy, ammonia); bleed at one arm, transfuse blood or "normal salt solution" by the other; 3. *Insects, Bees, Wasps, Hornets:* Apply locally ammonia water or some alkaline solution, may saturate cloth with ammonia water or sodium chloride solution and lay over part until pain dispelled; remove sting by pressing a watch-key over it. give stimulants (ammonia, wine, etc.), may apply onion to wound, but not of much value.

Bromal Hydrate: Large doses kill in a few minutes, with contracted pupil, dyspnea, and convulsions, death from failure of respiration; acts on heart muscle direct, much more powerful than chloral hydrate. Inhale abundant fresh air, ammonia, empty stomach, cardiac stimulants (strong coffee, alcohol, caffeine, digitalis), cold to head, warmth to extremities, strychnine, electricity, amyl nitrite, artificial respiration, quietness.

Bromine, Bromides: For bromine, if swallowed, give well-diluted ammonia water, olive or almond oil; if inhaled, then breathe ammonia vapor and abundant fresh air, for bronchial irritation inhale a little chloroform. For bromides give cardiac stimulants (strong coffee, caffeine citrate, digitalis), morphine is the best antagonist for mental symptoms, may give strychnine, ergot, belladonna, cathartics, diuretics.

Camphor: Empty stomach, give alcohol or brandy in small and frequent doses (best hypodermically), coffee, ether inhalations, alternate hot and cold douche, warmth to extremities by hot blankets, etc., opium and bromides for convulsions.

Cannabis: Somewhat similar to opium and chloral hydrate. Emetics, lemon juice to neutralize, tannin, hot coffee, hypodermic atropine (gr. $\frac{1}{120}$; .00054 Gm., every 15 minutes for 3 doses), ammonia, strychnine, electricity to chest muscles, artificial respiration, keep awake, also body warm, empty bladder often.

Cantharides, Cantharidin: Empty stomach, give demulcent drinks freely (barley, elm, flaxseed tea, diluted egg-white, gruel or pure water), hypodermic morphine or tincture of opium (by mouth or rectum) to allay pain and gastro-enteritis; avoid oils and oily emulsions, as these favor solubility and absorption of cantharidin, stimulants, warmth to extremities, warmth and cataplasms to abdomen; powdered drug ℥ss (2 Gm.) or tincture ℥j (30 cc.) usually proves fatal.

Carbon Disulphide: Vomit, give potassium bromide and chloral hydrate (for nervous excitement), stimulants (to support circulation), inhale ammonia, warmth to body, cold douche to head, artificial respiration.

Castor Beans: Vomit at once, give demulcent drinks, opium for pain and to quiet violent symptoms, which resemble those of cholera; 3 seeds, also 20, have each killed in 2 and 5 days.

Chloroform, Ether, Nitrous Oxide Gas: Withdraw at once the source, lower well the head, pull tongue forward, to admit fresh air, compress and relax chest, ammonia and amyl nitrite inhalations, warmth and friction to extremities, hot and cold douche, weak current—one pole on the larynx, other on the pit of stomach; if heart stopped, give several taps over that region, inhale ammonia, brandy, atropine, strychnine, artificial respiration. If swallowed, treat as chloral hydrate; vomit, enema of hot coffee, draughts of water containing sodium carbonate or bicarbonate, ammonia, warmth; chloroform inhalation kills 1 in every 3,000; ether, 1 in every 16,000; nitrous oxide gas, 1 in every 300,000.

Chlorates, Nitrates (Potassium, Sodium, etc.): Vomit, plenty of

water and demulcent drinks for dilution, amyl nitrite, opium for pain, hot fomentations to loins; avoid stimulants (increase kidney congestion); ʒviij–12 (30–45 Gm.) usually prove fatal in a few hours.

Chloral Hydrate: Empty stomach. give coffee by mouth or rectum (using tube if necessary), abundant fresh air, friction, cataplasm to limbs and over heart, hypodermic strychnine or picrotoxin every 15 minutes, keep awake by coffee, caffeine, flagellation, shaking, shouting, ammonia to nostrils, cold to head; if serious, place in recumbent position, absolute rest, amyl nitrite inhalations (to stimulate circulation), artificial respiration; ʒss–1 (2–4 Gm.) has killed.

Chlorine Water, etc.: Give emetic, warm water, then milk, egg-white (albumen), flour with water or lime water, ammonia water.

Cocaine, Eucaine: Similar to belladonna, etc., as they closely resemble atropine in action on pulse, pupils, respiration, sweat-glands, and bowels. Empty stomach, give tannin, morphine (best antidote), then in sequence chloral hydrate, chloroform, ether, alcohol, amyl nitrite to stimulate circulation, strychnine, artificial respiration, caffeine, ammonia inhalations.

Colchicum (Wine, Tincture, Extract, Fluidextract, etc.): Unless vomiting and purging already have occurred, induce at once the former, give tannin (gr. 30; 2 Gm.), gallic acid, strong coffee or tea, abundant water, demulcent drinks, morphine or opium to allay pain, purging and heart depression, cardiac (diffusible) stimulants, hot fomentations to abdomen, keep extremities (feet, hands) warm; powdered root gr. 50 (3.3 Gm.), seeds ʒiv (15 Gm.), root wine ʒiv (15 cc.), have each proved fatal.

Conium, Coniine: Emetics or lavage, tannin, strong coffee, tea, again wash out stomach, external warmth (hot wraps, bags, bottles, etc.), epispastics, alcohol, stimulants, strychnine, picrotoxin, hypodermic atropine, artificial respiration, castor oil; coniine ♏j–2 (.06–.13 cc.) usually fatal in 1–3 hours.

Colocynth, Elaterium, Elaterin: Empty stomach, give demulcent drinks, enemas, opium for pain (small doses), warm bath, stimulants (brandy, whisky, etc.).

Croton Oil: Empty stomach, give hypodermic morphine or laudanum every 20 minutes until pain and purging abated, demulcent drinks, mucilage, milk, egg-white, olive oil, soup, spirit of camphor, stimulants, warmth and friction; ʒss–2 (2–8 cc.) have killed in 4–6 hours.

Curarine, Woorare, Urare: If wounded, ligate above injury, suck forcibly, and wash well with alkaline solution (potassium permanganate), warmth to loins, abundant water, spirit of ethyl nitrite (to aid urine elimination), artificial respiration, empty bladder often; resembles digitalis much more than it does strychnine.

Digitalis, Convallaria, Scoparius, Strophanthus, Apocynin, Scillain, Scillitin: Vomit or wash out the stomach well with warm water and tannin, strong coffee, tea; keep reclined, never allowing erect position, as that may cause fatal syncope; aconitine (gr. $\frac{1}{200}$; .0003 Gm.), or tincture of aconite (♏v; .3 cc.) best for large quantities, opium best

following prolonged usage, saponin and senegin best physiological antagonist, diffusible stimulants by mouth or rectum, warmth and friction to extremities (feet, hands); powdered drug ʒss (2 Gm.), tincture ʒij–4 (8–15 cc.), have proved fatal.

Ergot: Empty stomach, give plenty warm drinks, tannin, coffee, tea, quick purgative (croton oil ♏j; .06 cc.), recumbent position, small does of opium at intervals for pain and irritation, nitroglycerin occasionally (gr. $\frac{1}{50}$; .0013 Gm.), hot baths, warmth, friction to maintain circulation), stimulants, amyl nitrite.

Gamboge, Scammony, Aloe, Ipomœa, Jalap: If vomiting and purging have not occurred, induce former by usual emetics, may give solution of potassium or sodium carbonate, magnesium oxide in milk, demulcent drinks, and enemas, opium in small doses to allay pain and purging.

Gelsemium, Gelsemine: Emetic or wash out stomach with tannin solution, then hypodermic atropine and morphine, warmth and friction, cardiac stimulants (digitalis, alcohol, coffee, ammonia), artificial respiration, electricity, rouse patient by cold and hot douche; fluid-extract ʒj (4 cc.), or tincture ʒiv (15 cc.), are usually fatal.

Gases: 1. *Chlorine:* Inhale cautiously ammonia or hydrogen sulphide, steam often valuable for breathing, abundant fresh air, egg-white, milk, flour, lime water, demulcent drinks, chloroform or ether inhalations for cough; 2. *Hydrogen Sulphide:* Chlorine gas well diluted with air cautiously inhaled, fresh air; 3. *Illuminating-gas, Carbon Dioxide, Carbon Monoxide* (exhaust from gasoline engines contains 6 p. c. CO): Remove clothing, open doors and windows, abundant air, oxygen, horizontal position, alternate cold and warm douche to chest and head, ammonia inhalations, diluted chlorine gas carefully breathed, faradic current to extremities, alcohol by mouth or rectum, strong coffee by enema, artificial respiration, venesection, warmth to body and limbs, place in bed, direct quietness, circulating air, cold acid drinks freely.

Glass—coarse or powdered: Large quantity of bread-crumbs as an envelope, then emetics.

Hyoscine: Similar to belladonna, but chloral hydrate is used here with great advantage.

Iodine: Give starch in hot water, or flour in warm water, farinaceous substances (rice, arrowroot, gruel, etc.), then vomit, demulcent drinks, egg-white in milk, sodium bicarbonate, stimulants (alcohol, digitalis), amyl nitrite, atropine, strychnine, opium or morphine for pain.

Ipecac: Unless thoroughly vomited, empty stomach, washing it out with tannin solution, if necessary follow with opium, belladonna, cardiac (diffusible) stimulants.

Iodoform, Iodol, Aristol: Give potassium bromide, to dissolve iodine compound, lemonade, potassium acetate solution, stimulants, diaphoretics, warm sponge bath, small repeated doses of tincture of opium, large doses of potassium bicarbonate, diluents freely.

Lead and Barium Salts: Give magnesium or sodium sulphate (ʒss;

15 Gm.) in a glass of water to form insoluble sulphate, then vomit, follow with purgative enema, demulcent drinks, milk, egg-white, diffusible stimulants, opium for pain; for lead colic apply hot-water bag, hot fomentations; for chronic lead poisoning, recognized by blue line (sulphide) along margin of gums, drop-wrist (extensors paralyzed), constipation, etc., give iodides to saturation (sodium and calcium being best), sulphur or sulphurated potassa baths, sulphuric acid, friction to muscles, calomel, lemonade, strychnine, faradic current.

Lobelia: If patient has failed to vomit, use emetic, follow with tannin, cardiac and respiratory stimulants, strychnine or picrotoxin hypodermically, opium, thebaine, alcohol, digitalis, atropine, ergot; caustic alkalies decompose lobeline, also preparations; ʒj (4 Gm.) has killed.

Mercury and Copper Salts (Corrosive Sublimate, Nitrate, White Precipitate, etc.): Give egg-white, beaten up with water (1 egg for every 4 grains (.26 Gm.) of corrosive sublimate), follow with emetic at once, to avoid re-solution, after this potassium citrate gr. 10–15 (.6–1 Gm.) every 2 hours alternately with magnesium sulphate gr. 60 (4 Gm.), demulcent drinks, stimulants, warmth, friction, opium or morphine for pain; in the absence of egg-white, use flour-paste, or milk, or meat-broth, if absorbed give intravenously sodium thiosulphate gr. 10 (.6 Gm.), and repeat in 6 hours if necessary; for copper salts may give additionally reduced iron, weak solution of potassium ferrocyanide, then potassium iodide until system saturated to promote elimination; tannin, strong coffee, tea useful in combating these metallic salts; for salivation, use bismuth, sodium sulphite, weak nitric or sulphurous acid, belladonna to diminish ptyalism; corrosive sublimate gr. 3–5 (.2–.3 Gm.) are usually fatal in ½–2 days; copper sulphate and acetate, ʒviij (30 Gm.) and ʒiv (15 Gm.), respectively, have killed in 4–12 hours.

Mezereum: Evacuate stomach with warm albuminous or mucilaginous drinks, then milk, fatty oils, demulcent enemas, opium for depression, cold poultices to abdomen.

Mushrooms, Poisonous Fungi, Muscarine: Empty stomach, give hypodermic atropine or tincture of belladonna, tannin, castor oil and enema to remove fungi from lower bowel, alcoholic stimulants, warmth, friction, poultice to abdomen.

Nitroglycerin, Amyl Nitrite: Give atropine, strychnine, picrotoxin, digitalis to increase functional activity of spinal cord and sympathetic system, stimulants, artificial respiration, alternate cold and hot douche to head, ergotin.

Opium, Lactucarium, Morphine, Codeine, Laudanum, etc.: If taken by mouth, give at once ½ p. c. solution of potassium permanganate (ʒviij; 240 cc.), then empty stomach by pump, apomorphine, etc., washing it out well with strong hot coffee, leaving therein at least a pint (.5 L.), tannin solution, keep body warm but alternate hot and cold douche to the head, hypodermic atropine and strychnine as respiratory stimulants (every 15 minutes for 3 doses), electricity to chest muscles, artificial respiration, digitalis as heart stimulant, ammonia inhalations, amyl nitrite, keep awake by shaking, flicking with a towel,

cold water over face and chest, walking between attendants; evacuate bladder often to prevent reabsorption. If poison taken hypodermically, proceed as outlined—omit antidote and vomiting; opium gr. 5 (.3 Gm.), or morphine gr. 1 (.06 Gm.), usually prove fatal in 5–12 hours.

Phenol (Carbolic Acid), Creosote, Resorcinol: The pneumogastric filaments, in mucous membrane of the stomach, are usually so obtunded as not to respond to emetics, so if considered safe, empty stomach with pump or hypodermic of apomorphine, or give as soon as possible alcohol ʒiv (120 cc.) mixed with equal quantity of water, remove at once by emetic or tube, repeat this every 5–10 minutes for 4 to 8 times; alcohol stimulates and protects stomach from corrosive action of poison, may employ diluted acetic acid for alcohol; or may wash out the stomach with 10 p. c. solution sodium bicarbonate (ʒviij; 240 cc.), following with antidote—magnesium or sodium sulphate (ʒij; 60 Gm.), in weak solution, to form harmless sulphophenolate, then demulcent drinks, egg-white (to protect mucous surfaces), but no oils or glycerin; stimulate with whisky, brandy, alcohol, ammonia, and if necessary digitalis, strychnine, warmth and friction to extremities (feet, hands), counter-irritants to abdomen, opium for pain, atropine. To local abrasions apply sodium carbonate solution, using same for mouth-wash; the brownish or blackish urine and eschars serve to identify this poison.

Phosphorus, Rat Paste, Matches: Empty stomach, preferably with copper sulphate (gr. 3; .2 Gm., repeated 2–4 times at 5-minute intervals) to form insoluble black phosphide, follow every half-hour with old viscid (oxygenated, acid, French) oil of turpentine (ʒj; 4 cc.), floated on water, follow with magnesium sulphate (ʒj–3; 30–90 Gm.) in a glass of water as a cathartic; may give magnesium hydroxide, lime water, charcoal. Phosphorus in solution—pot. permang. to cause oxidation, opium for pain; albumen, egg-white valuable—never fats or fatty oils, as these are solvents and aid its absorption; empty bladder often; phosphorus gr. 1 (.06 Gm.) is usually fatal in 1–5 days.

Physostigma, Physostigmine, (Eserine): Evacuate stomach, give tannin, coffee, tea, hypodermic atropine every 15 minutes until pupils dilated and pulse strong; if this should fail, give chloral hydrate (gr. 10; .6 Gm.) at same intervals, or hypodermic strychnine, then cardiac stimulants (alcohol, coffee, digitalis, ammonia), artificial heat and respiration, electricity; empty bladder often; 6 seed have killed.

Phytolacca: Similar to aconite and veratrum, but unlike the latter in that vomiting ensues much more slowly; within 2 hours usually acts *per se* as an emeto-cathartic, after which give cardiac stimulants (alcohol, ammonia, ether, digitalis, etc.), opium for pain.

Pilocarpus, Pilocarpine: Similar to physostigma; evacuate stomach, washing it out well with tannin solution, follow with hypodermic atropine (gr. $\frac{1}{60}$; .001 Gm.), or tincture of belladonna (♏xx; 1.3 cc.), every 20 minutes until pupils dilated; morphine to control nausea and vomiting, cardiac (diffusible) stimulants.

Ptomaines: Toxic alkaloids in meat, sausage, pork, fish, lobster (canned or otherwise), poisoned game, putrescent food, cheese, etc.): Empty stomach at once, using large draughts of warm water, tannin, coffee, tea; castor oil—after it operates give diluted vinegar, alcoholic stimulants for depression, warmth to abdomen, friction to extremities, opium for spasms, sponge body with weak alkaline solution.

Savin, Sabina Oil and Tops, Tansy and Oil: If not already vomited give at once an emetic, move bowels freely with Epsom salt, castor oil (full dose), stimulants, allay pain with morphine and demulcents, flaxseed meal poultice to stomach.

Poison Ivy (Oak): Apply at once locally soap and water with scrubbing-brush, then lead water, alkaline solutions (sodium thiosulphate, sodium bicarbonate, sulphite, chlorinated, diluted ammonia, soapsuds, alum curd), tincture or infusion of lobelia, grindelia, sassafras, impatiens biflora, cocaine solution, aristol, opium; internally cooling drinks, low diet, saline purgatives, quietness.

Quinine, etc.: Give potassium bromide, hydrobromic acid, cardiac and respiratory stimulants; morphine counteracts cerebral action, atropine the nervous, cardiac, and antipyretic effects.

Silver Salts, Nitrate, Lunar Caustic: Give sodium chloride (table salt) ʒiv (15 Gm.), dissolved in a glass of warm water to form insoluble silver chloride, or use egg-white, or milk, follow with emetic and large draughts of warm water, demulcent drinks; may use alkalies, alkaline carbonates, lime water, tannin. Following prolonged usage, give purgatives, diuretics, potassium iodide, sodium thiosulphate baths.

Staphisagria, Stavesacre: Similar to aconite and veratrum; evacuate stomach, then tannin, charcoal, diffusible stimulants, keep quiet, recumbent, feet elevated, extremities warm; chloroform inhalations for spasms, or chloral hydrate (gr. 30; 2 Gm.), or potassium bromide (ʒj–2; 4–8 Gm.); use all haste, as death is by asphyxia.

Strychnine, Brucine, Nux Vomica, Ignatia, Picrotoxin, Cocculus Indicus, Hydrastis: Remove patient from all noise, quickly evacuate stomach, give tannin (gr. 30; 2 Gm.) dissolved in water, or iodide of starch to form insoluble strychnine perhydroiodide, charcoal; control spasms by inhaling chloroform or ether, or by large doses of chloral hydrate and potassium bromide in solution by mouth or rectum, thus keeping up mild narcosis for several hours if necessary; spasms may stop respiration, hence control these at all risk, amyl nitrite, artificial respiration, soluble iodides, tobacco, opium, physostigmine, atropine, conium, Indian hemp; empty bladder often; nux vomica gr. 30 (2 Gm.), or extract gr. 3 (.2 Gm.), or strychnine gr. ½–1 (.03–.06 Gm.), is each usually fatal in ¼–3 hours.

Tobacco, Nicotine: Induce vomiting if not already accomplished, give quietness, recumbent position, tannin, strong coffee, tea, then an emetic, hypodermic strychnine (physiolog. antid.) or tr. nuc. vom. (mouth), diffusible stimulants (alcohol, brandy, whisky, ether), warmth to body, ergot, digitalis, belladonna, iodides, artificial respiration, cold douche to head; nicotine ♏xv–60 (1–4 cc.) is fatal in 1–3 hours.

Tin Salts: Empty stomach, then milk of magnesia, demulcent drinks, opium for pain.

Turpentine: Emetics, if no purging give enema, then plenty of water and demulcent drinks, hot fomentations to loins, opium to allay pain.

Zinc Salts, Sulphate, Chloride, Burnett's and Platt's Solutions: Should vomiting not have occurred, give plenty warm water containing sodium carbonate or bicarbonate to form insoluble zinc carbonate, or mustard (ʒij; 8 Gm.), then egg-white and milk, tannin solution, strong coffee, tea, to form insoluble tannate, opium, morphine, hot fomentations to allay abdominal pain; sulphate ʒxij (45 Gm.) are usually fatal.

Veratrum Viride, Veratrum Album, Veratrine, Sabadilla: Evacuate stomach, unless veratroidine constituent has thus acted, recumbent position, feet elevated, dry warmth to body (wraps, blankets, bottles, etc.), tannin, strong hot coffee, tea, cardiac (diffusible) stimulants (alcohol, brandy, ammonia, etc.), atropine to antagonize cardiac depression, strychnine as respiratory and nervous stimulant, morphine, electricity, artificial respiration.

PRESCRIPTION-WRITING OF THE PHYSICIAN.

Prescriptions (L. *præscriptio*, a writing before, an order; fr. *præscrib(o)-ere*, to write before, to ordain) are *ex tempore formulæ* written in Latin, usually at the bedside, to combat specific conditions, and in their construction certain rules, forms, and requisites must be observed:

1. *Chirography.*—Learn to write legibly, letting your style be plain, neat, thoroughly intelligent without possible ambiguity or doubt for the compounder as to what is intended. Make this your first imperative duty, and if, when a student, your penmanship is indifferent, then at once begin the trial for improvement; this can and will alone come by careful practice, so make sure that you know how to write before knowing what to write.

2. *Prescription Blanks.*—Do not be careless as to the kind and style of paper used, It is well to have uniformity in blanks, and whenever your regular supply becomes exhausted, if possible, replenish at once, using in the interim good, white, unruled paper cut to a specific size. A neglect of this might occasion discourteous remarks somewhere along the line (by attendant, compounder, etc.), which should and can easily be avoided. Blanks are, as a rule, furnished gratuitously by the druggists (who are only too well pleased to have the number great), and in size should be neither too large nor too small, but in keeping with the boldness of individual handwriting. On the other hand, when the style and printing of those supplied are not satisfactory, then others more to one's liking should be secured from the printer at your own expense.

3. *Weights and Measures.*—Of these we may employ three systems:

1. Avoirdupois (Imperial). This has the following subdivisions: grain (gr.), drachm (drm.), ounce (oz.), pound (lb.), and is thus proportioned: 27.35 grains make 1 drachm, 16 drachms make 1 ounce (437½ grs.), 16 ounces make 1 pound (7,000 grs.), 27.35—437½—7,000. By this system all substances are sold except precious stones,

precious metals, and drugs when prescribed by a physician directly or indirectly for sickness.

2. Apothecaries' (Troy). This has the following subdivisions: grain (gr.), scruple (℈), dra(ch)m (ʒ), ounce (℥), pound (lb), and is thus proportioned: 20 grains make 1 scruple, 3 scruples make 1 drachm, 8 drachms make 1 ounce, 12 ounces make 1 pound, 20—60—480—5760. The difference between the two pounds mentioned is 1240 grains, the two ounces 42 grains, the two drachms 32.65 grains. The grain, however, is the same the world over, and is the *unit of weight.*

United States Fluid, Liquid, or Wine Measure. This has the following subdivisions: minim (♏), fluidra(ch)m (fʒ), fluidounce (f℥), pint (O), gallon (Cong.), and is thus proportioned: 60 minims make 1 fluidrachm, 8 fluidrachms make 1 fluidounce, 16 fluidounces make 1 pint (2 pints make 1 quart), 8 pints (4 quarts) make 1 gallon, 60—480—7680—61,440 (58,340 grs.). The minim is the *unit of capacity,* and weighs 0.95 of a grain, the ounce weighing 455.7 grains.

Imperial Liquid Measure (Gt. Britain). This has the following subdivisions: minim (min.), dra(ch)m (fl. dr.), ounce (fl. oz.), pint (O), gallon (C.) and is thus proportioned: 60 minims make 1 drachm, 8 drachms make 1 ounce, 20 ounces make 1 pint, 8 pints make 1 gallon, 60—480—9600—76,800 (70,000 grs., or 10 lbs. Avd.). This minim weighs 0.91 of a grain, the ounce weighs 437.5 grains. It is thus seen that we have two minims (0.95—0.91 grain) and three ounces (437.5—455.7—480 grains).

3. Metric, Decimal, or French. This system is based upon the earth's polar circumference (24,818 miles), of which the one-forty-millionth part, 39.37 inches, is taken as the *unit of length* (meter); of the meter one-tenth, 3.93 inches, is taken, and upon it a cube constructed, which contains of distilled water 1000 cc. or Gm., when taken at 4° C. (39.2° F.), and this furnishes the *unit of capacity* (liter); again, of the meter the one-hundredth part, .393 of an inch, is taken, and upon it a cube constructed, which contains of distilled water 1 cc., weighing 15.434 grains, and this furnishes the *unit of weight* (gramme).

Milli-meter,	mm.,	-liter,	ml.,	-gramme,	mg.	= .001
	(Cubic centimeter, cc.)					
Centi-meter,	cm.,	-liter,	cl.,	-gramme,	cg.	= .01
Deci-meter,	dm.,	-liter,	dl.,	-gramme,	dg.	= .1
METER,	M.,	LITER,	L.,	GRAMME,	Gm.	= 1.
Deka-meter,	Dm.,	-liter,	Dl.,	-gramme,	Dg.	= 10.
Hecto-meter,	Hm.,	-liter,	Hl.,	-gramme,	Hg.	= 100.
Kilo-meter,	Km.,	-liter,	Kl.,	-gramme,	Kg.	= 1,000.
Myria-meter,	Mm.,	-liter,	Ml.,	-gramme,	Mg	= 10,000.

Here every unit is multiplied or divided by 10, consequently each preceding denomination is just 10 times smaller than the one that follows, thus it takes 10 millimeters to make 1 centimeter, 10 centimeters to make 1 decimeter, etc.

4. *Prescription.*—This consists of four parts: 1. Superscription (date, name and address of patient; also regular sign, ℞, fr. L. *recipio,*

recipere, to take; *recipe*, take thou); 2. Inscription (the body, consisting of *basis* or chief ingredient, *adjuvant* or assistant to basis, *corrective* or anything to correct the injurious quality of the two preceding, *vehicle* or *excipient* to make it pleasant and of suitable form; 3. Subscription (directions to the compounder, usually in Latin); 4. Signature (directions for taking, also physician's name, in English).

A prescription may consist of a single article, the base, and although the fewer the drugs combined often the better, yet sometimes much good results from mixing several, as in the case of cathartics, of which different ones act upon various portions of the canal. Every article should be written in the Latin genitive, and if of several parts each should receive this ending. It is, however, very seldom that the physician adheres absolutely to this rule, as he so often omits terminations and otherwise abbreviates, a habit that frequently gives ambiguity and sometimes annoyance to the compounder.

Words having nominative ending in *a*, have genitive in *æ;* those in *us, um, os, on = i; as = atis; is = idis, eris, itis; o = onis, inis,* etc. The quantities are governed by the verb *recipio,* hence are in the objective case, and when expressed in Latin nomenclature, which is very rare, should be placed in the accusative. The English of the average prescription has about this form: Take thou (imp.) of drugs (gen.) certain quantities (acc.), mix thou (imp.), let (thou) a solution, mixture, pills, etc. (nom. s. or pl.), be made (sub. used as passive imp.).

Superscription.	℞. For Mrs. Randolph, 105 W. Monument St., July 1, 1927.			
Inscription.	(Basis.)	Morphinæ Sulphatis,	gr. iv	0.26 Gm.
	(Adjuvant.)	Sodii Bromidi,	℥ij	8. Gm.
	(Corrective.)	Syrupi Aurantii,	℥j	30. cc.
	(Vehicle.)	Aquæ Cinnamomi, q. s. (ad)	℥iv	120. cc.
Subscription.	M., ft. mist. (sol.).			
Signature.	S. (Sig.) Teaspoonful every 3 hours.			

Dr. Barker.

5. *Abbreviations.*—Only such as are in common use, along with accustomed signs should be employed, as: ℈, ℥, ℨ, ♏, M, O, ss, āā, ad, gr., gtt., ft., lb., et, ss, q. s., sig., cong., misce., mist., cap., chart., emul., pil., solv., sol., pulv., etc. The following should always be avoided: aconit. (for aconitine, aconitum), ammon. (ammonia, ammoniacum), aq. chlor. (aqua chlori, aqua chloroformi), chlor. (chlorine, chloral, chloroform), hyd. chlor. (calomel, corrosive sublimate, chloral hydrate), sod. sulph. (sodium sulphite, sulphide, sulphate), zinc. phos. (zinc phosphate, zinc phosphide), ac. hydroc. (acid hydrochloric, acid hydrocyanic diluted), ext. col. (extract colchicum, extract colocynth), sod. hypo. (sodium hyposulphite or hypophosphite), aq. fortis (for aq. fontis), barii sulph. (barium sulphide, sulphite, or sulphate), etc.

6. *Essentials.*—After having made the diagnosis, then carefully consider the medicines most desirable, their demanded quantities and number of doses, trying never to prescribe more than necessary. See that the doses are neither too large nor follow each other so often as to

endanger life—smaller and oft-repeated ones always being advisable. Avoid combining in one prescription medicines that will form poisonous compounds, have physiological imcompatibilities, or will favor chemical decomposition. Let prescriptions be as simple as possible, having the smallest number of ingredients that will secure the desired effect. Always read them over carefully before finally handing same to attendant, and rewrite rather than permit a visible correction to exist. Large doses should always be underscored with a heavy line by the physician, and when desiring certain presciptions not to be repeated, he should so mark the blank with the two words *non-repetatur*. When incompatibilities are intentional they should be so indicated by a marginal note; when otherwise the pharmacist will consider it his duty and privilege to make the necessary correction or remedy.

TABLE OF COMPARISON BETWEEN METRIC, AVOIRDUPOIS, AND APOTHECARIES' WEIGHTS.

Names.		Numerical Expressions. Gm.	Equivalents in Grains. Gr.	Equivalents in Avoirdupois Weight. lb.	oz.	gr.	Equivalents in Apothecaries' Weight. ℥	ʒ	gr.
Milligramme,	Mg. (mg.)	0.001	0.01543	0	0	$\frac{1}{64}$	0	0	$\frac{1}{64}$
Centigramme,	Cg. (cg.)	0.01	0.15432	0	0	$\frac{1}{6}$	0	0	$\frac{1}{6}$
Decigramme,	Dg. (dg.)	0.1	1.54323	0	0	1.5	0	0	1.5
Gramme,	Gm. (gm.)	1.0	15.43235	0	0	15.4	0	0	15.4
Dekagramme,	Dg.	10.0	154.32356	0	$\frac{1}{4}$	45.0	0	2	34.0
Hectogramme,	Hg.	100.0	1543.23563	0	$3\frac{1}{2}$	12.0	3	1	43.0
Kilogramme,	Kg.	1000.0	15432.35639	2	$3\frac{1}{4}$	10.47	32	1	12.4
Myriagramme,	Mg.	10000.0	154323.56390	22	$\frac{1}{2}$	14.8	321	4	3.5

In writing presciptions physicians usually consider 1 Gm. as being 15 gr., 4 cc. as 1 fluidrachm, 30 cc. as 1 fluidounce.

TABLE OF COMPARISON BETWEEN METRIC AND APOTHECARIES' FLUID MEASURE.

Cubic Centimeters.	Minims.	f℥	f℥	♏
0.06163	1.0			
0.30815	5.0			
0.61630	10.0			
1.0	16.23			
5.0	81.15		1	21.15
10.0	162.30		2	42.3
20.0	324.60		5	24.6
30.0	486.90	1	0	6.9
40.0	649.20	1	2	49.2
50.0	811.50	1	5	31.5
60.0	973.80	2	0	13.8
70.0	1136.10	2	2	56.1
80.0	1298.40	2	5	38.4
90.0	1460.70	3	0	20.7
100.0	1623.00	3	3	3.0
250.0	4057.50	8	3	37.5
500.0	8115.00	16	7	15.0
1000.0	16230.00	33	6	30.0

CORRESPONDING VALUES WHICH SHOULD BE MEMORIZED BY EVERYONE.

1 millimeter, Mm. (mm.) = $\frac{1}{25}$ of an inch. 1 centimeter, Cm. (cm.) = $\frac{2}{5}$ of an inch.
1 inch = 25 millimeters or $2\frac{1}{2}$ centimeters.
1 cubic centimeter, cc. = 16.23 minims. 1 fluidounce = 29.53 cc.
1 gramme, Gm. (gm.) = 15.4324 grains. 1 grain = .0648 gramme.
1 milligramme, Mg. (mg.) = .01543 = $\frac{1}{64}$ grain. 1 kilogramme, Kg. = $2\frac{1}{5}$ pounds.
1 litre, L. = 34 fluidounces = $2\frac{1}{8}$ pints.

Rule 1.—To convert grains (whole) into metric, multiply the metric equivalent of 1 grain—0.0648, by the number of grains in question, say 30, thus 0.0648 × 30 = 1.944 Gm.; for fractions of grain divide the denominator of the fraction into 0.0648, and multiply quotient by numerator—say $\frac{1}{64}$, thus 0.0648 ÷ 64 = 0.001 × 1 = 0.001 Gm.

2. To convert diminutive metric lengths, expressed decimally, into common fractions of an inch: form a common fraction, reduce to lowest terms, multiply denominator by 25. (1) .03 Mm. = $\frac{0\,3}{1\,0\,0}$, ÷ 3 = $\frac{1}{3\,3}$ × 25 = $\frac{1'}{8\,2\,5}$ of an inch; (2) .003 Mm. = $\frac{0\,0\,3}{1\,0\,0\,0}$, ÷ 3 = $\frac{1}{3\,3\,3}$ × 25 = $\frac{1'}{8\,3\,2\,5}$ of an inch; (3) .0003 Mm. = $\frac{0\,0\,0\,3}{1\,0\,0\,0\,0}$, ÷ 3 = $\frac{1}{3\,3\,3\,3}$ × 25 = $\frac{1'}{8\,3\,3\,2\,5}$ of an inch.

Measures of Approximation.

While these equivalents are not precisely accurate, their values have so long been recognized by laymen on the one hand, and physicians on the other, that they will possibly always be thus accepted:

A drop	♏j	.06	cc.
A teaspoonful	℥j	4	cc.
A desertspoonful	℥ij	8	cc.
A tablespoonful	℥iv	15	cc.
A wineglassful	℥ij	60	cc.
A teacupful	℥iv	120	cc.
A tumblerful	℥viij–xj	240–325	cc.
A breakfastcupful	℥viij	240	cc.

Another likely source of error in weights and measures arises from quantities purchased in original containers from the manufacturers. Thus we speak of drachm vials of morphine sulphate, which in point of fact contain only one-eighth of 437.5 gr.—indeed, all solids when thus purchased have per ounce only the 437.5 gr., yet per pound sixteen times this amount, or 7000 gr. With liquids the result is often much more misleading, especially of those having low or high specific gravities. These are sold mostly originally by weight, which causes the bulk often to be at variance with what some might expect.

1 ℔	453 Gm. Sulphuric Acid	℥$8\frac{1}{2}$	250	cc.
1 ℔	453 Gm. Liquor Ferri Subsulphatis	℥10	296	cc.
1 ℔	453 Gm. Chloroform	℥$10\frac{1}{2}$	305	cc.
1 ℔	453 Gm. Syrup Simple	℥$11\frac{3}{4}$	350	cc.
1 ℔	453 Gm. Glycerin	℥$12\frac{1}{4}$	360	cc.
1 ℔	453 Gm. Liquor Plumbi Subacetatis	℥$12\frac{7}{8}$	380	cc.
1 ℔	453 Gm. Aqua Ammoniæ (10 p. c.)	℥16	473	cc.
1 ℔	453 Gm. " " (28 p. c.)	℥17	503	cc.
1 ℔	453 Gm. Spiritus Ætheris Nitrosi	℥$18\frac{1}{4}$	540	cc.
1 ℔	453 Gm. Essential Oil	℥13–18	385–532	cc.
1 ℔	453 Gm. Æther	℥$21\frac{1}{6}$	625	cc.

Table Giving the Maximum Quantities that Should be Prescribed Unless Special Directions Accompany the Prescription.

	Single doses.			Total amount in any one day.		
Acid Arsenous	gr.$\frac{1}{6}$	.01	Gm.	gr. $\frac{1}{2}$	.03	Gm.
Acid Hydrocyanic Diluted	♏x	.6	cc.	♏xxx 2		cc.
Acid Nitromuriatic	♏v	.3	cc.	♏xxx 2		cc.
Aconite Leaf, Extract of	gr. $1\frac{1}{2}$	.1	Gm.	gr. 10	.6	Gm.
Aconite Root, Fluidextract of	♏v	.3	cc.	♏xv 1		cc.
Aconite Root, Tincture of	♏vj	.4	cc.	♏xv 1		cc.
Aconite Root, Fleming's Tincture of	♏iij	.2	cc.	♏x	.6	cc.
Aconitine and its salts	gr. $\frac{1}{50}$	.0013	Gm.	gr. $\frac{1}{10}$	.006	Gm.

	Single doses.			Total amount in any one day.		
Arsenic Chloride, Solution of	ℳvj	.4	cc.	ℳxv	1.	cc.
Arsenic Iodide	gr. $\frac{1}{6}$	.01	Gm.	gr. $\frac{1}{2}$	.03	Gm.
Arsenic and Mercury, Solution of Iodides of	ℳxx	1.3	cc.	ℳlx	4	cc.
Arsenite of Potassium, Solution of	ℳxv	1	cc.	ℳxlv	3	cc.
Atropine and its salts	gr. $\frac{1}{60}$	.001	Gm.	gr. $\frac{1}{20}$	.003	Gm.
Belladonna, Extract of	gr. 1	.06	Gm.	gr. 5	.3	Gm.
Codeine	gr. 2	.13	Gm.	gr. 5	.3	Gm.
Coniine	gr. $\frac{1}{15}$	.004	cc.	gr. $\frac{1}{2}$	.03	cc.
Conium, Extract of	ℳ 2	.13	Gm.	gr. 8	.5	Gm.
Croton Oil	ℳij	.13	cc.			
Digitalin	gr. $\frac{1}{60}$	.001	Gm.	gr. $\frac{1}{20}$	.003	Gm.
Digitalis, Extract of	gr. $\frac{1}{2}$	.03	Gm.	gr. 1	.06	Gm.
Hyoscyamus, Extract of	gr. 3	.2	Gm.	gr. 10	.6	Gm.
Ignatia, Extract of	gr. 3	.2	Gm.	gr. 10	.6	Gm.
Cannabis, Extract of	gr. 1	.06	Gm.	gr. 5	.3	Gm.
Corrosive Sublimate	gr. $\frac{1}{4}$	.016	Gm.	gr. $\frac{3}{4}$	.05	Gm.
Mercuric Iodide, Red	gr. $\frac{1}{4}$	.016	Gm.	gr. 1	.06	Gm.
Mercurous Iodide, Yellow	gr. 1	.06	Gm.	gr. 3	.2	Gm.
Morphine and its salts	gr. $\frac{1}{2}$	.03	Gm.	gr. 2	.13	Gm.
Nux Vomica, Extract of	gr. 2	.13	Gm.	gr. 8	.5	Gm.
Opium	gr. 2	.13	Gm.	gr. 10	.6	Gm.
Opium, Extract of	gr. 1	.06	Gm.	gr. 4	.26	Gm.
Opium, Tincture of	ℳxxx 2		cc.	ℳcxx 8		cc.
Phosphorus	gr. $\frac{1}{6}$	.013	Gm.	gr. $\frac{1}{2}$	.03	Gm.
Physostigma, Extract of	gr. $\frac{1}{4}$	.016	Gm.	gr. 1	.06	Gm.
Potassium Cyanide	gr. $\frac{1}{4}$	.016	Gm.	gr. 1	.06	Gm.
Sodium Arsenate	gr. $\frac{1}{3}$	.02	Gm.	gr. 1	.06	Gm.
Stramonium Leaves, Extract of	gr. 2	.13	Gm.	gr. 5	.3	Gm.
Stramonium Seed, Extract of	gr. 1	.06	Gm.	gr. 3	.2	Gm.
Strychnine and its salts	gr. $\frac{1}{12}$	.005	Gm.	gr. $\frac{1}{4}$	.016	Gm.
Tartar Emetic	gr. 2	.13	Gm.			
Veratrum viride, Fldextract of	ℳiij	.2	cc.	ℳx	.6	cc.
Veratrum viride, Tincture of	ℳv	.3	cc.	ℳxij	.8	cc.

Doses of Rare and Unofficial Drugs, some not Treated of in this Work.

Abrastol, gr. 15–20..... 1–2 Gm.
Acetal, 3j–2..... 4–8 cc.
Acet-ortho-toluide, gr. 2–5.... .13–.3 Gm.
Acet-para-toluide, gr. 15–30..... 1–2 Gm.
Acetyl-amido antipyrine, gr. 10–30. .6–2 Gm.
Acid anticylic, gr. $\frac{1}{100}$..... .0006 Gm.
Acid cathartinic, gr. 3–6..... .2–.4 Gm.
Acid cubebic, gr. 5–10..... .3–.6 Gm.
Acid fluoric dil., ℳx–20..... .6–1.3 cc.
Acid hydriodic dil., 3j..... 4 cc.
Acid hydrocinnamic, gr. 1–2.. .06–.13 Gm.
Acid ortho-amido salicylic, gr. 2–5. .13–.3 Gm.
Acid osmic, gr. $\frac{1}{64}$..... .001 Gm.
Acid picric, gr. 1–5..... .06–.3 Gm.
Acid polygalic, gr. $\frac{1}{4}$–1..... .016–.06 Gm.
Adonin (adonidin), gr. $\frac{1}{16}$–$\frac{1}{3}$. .004–.02 Gm.
Agaricin, gr. $\frac{1}{2}$–2..... .03–.13 Gm.
Agathin, gr. 5–10..... .3–.6 Gm.
Alantol, gr. $\frac{1}{8}$..... .01 Gm.
Ammonium embelicum, gr. 2–6. .13–.4 Gm.
Ammonium picrate, gr. $\frac{1}{4}$–$\frac{1}{2}$. .016–.03 Gm.
Ammonium salicylate, gr. 5–20. .3–1.3 Gm.
Ammonol, 5–20..... .3 1.3 Gm.
Amyl valerate (valerianate), gr. 2–3. .13–.2 Gm.
Amylum iodatum, gr. 5–30..... .3–2 Gm.
Antikamnia, gr. 5–10..... .3–.6 Gm.
Antinervin, gr. 5–8..... .3–.5 Gm.
Antirheumatin, gr. 1–1½..... .06–.1 Gm.
Antispasmin, gr. $\frac{1}{6}$–1½..... .01–.1 Gm.
Antitetraizin, gr. 3–4..... .2–.26 Gm.
Antithermin, gr. 3..... .2 Gm.
Antitoxin, 3j–2..... 4–8 cc.
Apocodeine hydrochloride, gr. 1–1¼. .06–.09 Gm.
Aralia hispida, gr. 20–40..... 1.3–2.6 Gm.
Aralia racemosa, gr. 20–40... 1.3–2.6 Gm.
Arbutin, gr. 3–5..... .2–.3 Gm.
Arecoline, gr. $\frac{1}{20}$–$\frac{1}{10}$..... .003–.004 Gm.
Asparagin, gr. $\frac{1}{2}$–1½..... .03–.1 Gm.
Aspidospermine, gr. 1–2..... .06–.13 Gm.
Benzacetine, gr. 5–15..... .3–1 Gm.
Benzosol, gr. 4–8..... .26–.5 Gm.
Berberine, gr. $\frac{1}{2}$–1..... .03–.06 Gm.
Betol, gr. 5–8..... .3–.5 Gm.
Bismuth albuminate, gr. 8–15... .5–1 Gm.
Bismuth benzoate, gr. 5–10.... .3–.6 Gm.
Bismuth cerium salicylate, gr. 15–30. 1–2 Gm.
Bismuth naphtholate, gr. 15–30.. 1–2 Gm.
Bismuth salicylate, gr. 5–30.... .3–2 Gm.
Bismuth sulphite, gr. 5–15..... .3–1 Gm.
Bismuth valerate (valerianate), gr. 1–3. .06–.2 Gm.

Boldin, gr. 1..... .06 Gm.
Boldoa fragrans, gr. 15–30..... 1–2 Gm.
Bromal hydrate, gr. 1–15..... .06–1 Gm.
Bromalin, gr. 30–60..... 2–4 Gm.
Bromamide, gr. 5–10..... .3–.6 Gm.
Buxine, gr. 15–30..... 1–2 Gm.
Cactus grandiflorus, gr. 5–10... .3–.6 Gm.
Cæsium bitartrate, gr. 2–5.... .13–.3 Gm.
Caffeine chloral, gr. 3–5..... .2–.3 Gm.
Caffeine tri-iodide, gr. 2–4... .13–.26 Gm.
Calcium benzoate, gr. 10..... .6 Gm.
Calcium borate, gr. 3–6..... .2–.4 Gm.
Calcium salicylate, gr. 8–24... .5–1.5 Gm.
Camphor salicylate, gr. 1–4....06–.26 Gm.
Cannabinon, gr. $\frac{1}{2}$–1$\frac{1}{2}$..... .03–.1 Gm.
Carniferrin, gr. 3–5..... .2–.3 Gm.
Carpaine, gr. $\frac{1}{10}$–$\frac{1}{6}$..... .006–.01 Gm.
Cerium nitrate, gr. 1–2..... .06–.13 Gm.
Cetrarin, gr. 1–3..... .06–.2 Gm.
Chionanthus virginica, ʒss–1.... 2–4 Gm.
Chinoline salicylate, gr. 5–15... .3–1 Gm.
Chinoline tartrate, gr. 5–15..... .3–1 Gm.
Chloral ammonium, gr. 15–30... 1–2 Gm.
Chlorphenol, ♏xv-30..... 1–2 cc.
Cocaine borate, gr. $\frac{1}{8}$–2..... .008–.13 Gm.
Cocaine lactate, gr.$\frac{1}{8}$–2..... .008–.13 Gm.
Cocaine nitrate, gr. $\frac{1}{8}$–2..... .008–.13 Gm.
Cocaine saccharate, gr. $\frac{1}{8}$–2. .008–.13 Gm.
Codeine phosphate, gr. $\frac{1}{8}$–2.. .03–.13 Gm.
Convolvulin, gr. 1–2..... .06–.13 Gm.
Cornutine, gr. $\frac{1}{20}$–$\frac{1}{8}$..... .003–.01 Gm.
Coronillin, gr. 1–2..... .06–.13 Gm.
Corydalis, gr. 10–30..... .6–2 Gm.
Creosote carbonate, ♏iij–15..... .2–1 cc.
Curare, gr. $\frac{1}{10}$– $\frac{1}{8}$..... .006–.02 Gm.
Curarine, gr. $\frac{1}{64}$–$\frac{1}{32}$..... .001–.002 Gm.
Cystine, gr. $\frac{1}{20}$–$\frac{1}{12}$..... .003–.005 Gm.
Cystine nitrate, gr. $\frac{1}{20}$–$\frac{1}{12}$...003–.005 Gm.
Damiana, gr. 30–120..... 2–8 Gm.
Dioscorea, gr. 10–30..... .6–2 Gm.
Dita bark, gr. $\frac{1}{2}$–3..... .03–.2 Gm.
Drosera, gr. 5–10..... .3–.6 Gm.
Erythrophlœine, gr. $\frac{1}{32}$–$\frac{1}{16}$.. .002–.004 Gm.
Ethoxy caffeine, gr. 3..... .2 Gm.
Eucalyptol, gr. 10–20..... .6 1.3 Gm.
Euphorbia pilulifera, gr. 30–60.. 2–4 Gm.
Ferratin, gr. 3–8..... .2–.5 Gm.
Ferropyrine, gr. 5–15..... .3–1 Gm.
Fuchsine, gr. $\frac{1}{2}$–4..... .03–.26 Gm.
Gallo-bromol, gr. 15–120..... 1–8 Gm.
Gold bromide, $\frac{1}{20}$–$\frac{1}{10}$..... .003–.006 Gm.
Gold chloride, $\frac{1}{20}$–$\frac{1}{10}$..... .003–.006 Gm.
Gold monocyanide, $\frac{1}{20}$–$\frac{1}{4}$... .003–.016 Gm.
Gold tricyanide, $\frac{1}{20}$–$\frac{1}{4}$..... .003–.016 Gm.
Gurjun balsam, ʒss–2..... 2–8 cc.
Hæmogallol, gr. 3–5..... .2–.3 Gm.
Hæmol, gr. 1–8..... .06–.5 Gm.
Hæmoglobin, gr. 1–3..... .06–.2 Gm.
Helenin, gr. $\frac{1}{8}$..... .01 Gm.
Heliotropine, gr. 5–15..... .3–1 Gm.
Homatropine, gr. $\frac{1}{120}$–$\frac{1}{60}$ ..0005–.001 Gm.
Homatropine hydrobromide, gr. $\frac{1}{120}$–$\frac{1}{60}$. .0005–.001 Gm.
Hydracetine, gr. $\frac{1}{2}$–1$\frac{1}{2}$..... .03–.1 Gm.
Hydrangea, gr. 30–60..... 2–4 Gm.
Hydronaphthol, gr. 1–2..... .06–.13 Gm.
Iodo-caffeine, gr. 5..... .3 Gm.
Iridin (irisin), gr. 1–4..... .06–.26 Gm.
Iron benzoate, gr. 1–5..... .06–.3 Gm.
Iron dialyzed, ♏v–30..... .3–2 cc.
Iron magnetic oxide, gr. 5–10.. .3–.6 Gm.
Iron malate, gr. 5–15..... .3–1 Gm.
Iron pomate, gr. 5–15..... .3–1 Gm.
Kairin, gr. 2–10..... .13–.6 Gm.
Kava-kava, gr. 10–30..... .6–2 Gm.
Kosin, gr. 5–30..... .3–2 Gm.
Lactol, gr. 3–8..... .2–.5 Gm.
Lantanine, gr. 15–30..... 1–2 Gm.
Lipanin, ʒj–4..... 4–15 cc.
Lithium benzoate, gr. 5–15..... .3–1 Gm.
Lithium formate, gr 3..... .2 Gm.
Lithium salicylate, gr. 10–30.... .6–2 Gm.
Lithium sulphoichthyolate, gr. 5–8. .3–.5 Gm.
Lysidine, gr. 15–60..... 1–4 Gm.
Magnesium lactate, gr. 15–45... 1–3 Gm.
Magnesium phenolsulphonate, gr. 15–30. 1–2 Gm.
Magnesium salicylate, gr. 15–30. 1–2 Gm.
Malakin, gr. 10–15..... .6–1 Gm.
Malt extract, ʒj–2..... 4–8 cc.
Mercuric naphtholate, gr. 1..... .06 Gm.
Mercuric peptonate, gr. $\frac{1}{8}$..... .01 Gm.
Mercuric salicylate, gr. $\frac{1}{64}$–$\frac{1}{8}$. .001–.008 Gm.
Mercuric thymol-acetate, gr. $\frac{1}{12}$–$\frac{1}{8}$. .005–.01 Gm.
Mercuric thymolate, gr. $\frac{1}{12}$–$\frac{1}{8}$. .005–.01 Gm.
Mercurous acetate, gr. $\frac{1}{8}$–1... .01–.06 Gm.
Mercurous tannate, gr. 1–2.. .06–.13 Gm.
Mercury amido-propionate, gr. $\frac{1}{12}$–$\frac{1}{8}$. .005–.01 Gm.
Mercury formamidate (1 p. c. sol.), ♏v–15..... .3–1 cc.
Mercury imido-succinate, gr. $\frac{1}{12}$–$\frac{1}{8}$. .005–.01 Gm.
Mercury phenolate, gr. $\frac{1}{4}$–$\frac{1}{2}$. .016–.03 Gm.
Mercury sozo-iodolate, gr. 1..... .06 Gm.
Methylene blue, gr. 2–8..... .13–.5 Gm.
Methoxy caffeine, gr. 2–4.... .13–.26 Gm.
Migranin, gr. 10–15..... .6 1 Gm.
Morphine benzoate, gr. $\frac{1}{6}$–$\frac{1}{4}$. .01–.016 Gm.
Morrhuol, gr. 1–5..... .06–.3 Gm.
Myrtol, ♏v..... .3 cc.
Naphtol, gr. 5–15..... .3–1 Gm.
Narceine hydrochloride, gr. $\frac{1}{8}$–1. .01–.06 Gm.
Narcotine, gr. 3–10..... .2–.6 Gm.
Neurodine, gr. 10–20..... .6–1.3 Gm.
Oleo-creosote, ♏v–15..... .3–1 cc.
Orexine, gr. 2–6..... .13–.4 Gm.
Orthine, gr. 3–8..... .2–.5 Gm.
Ouabain, gr. $\frac{1}{1000}$..... .00006 Gm.
Oxy-sparteine, gr. $\frac{1}{2}$–1$\frac{1}{2}$..... .03–.1 Gm.
Papain, gr. 2–5..... .13–.3 Gm.
Papayotin, gr. 2–5..... .13–.3 Gm.
Paracresalol, gr. 3–30..... .2–2 Gm.
Phenidin, gr. 5–15..... .3–1 Gm.
Phenyl ester of anisic acid, gr. 8–15. .5–1 Gm.

Phloridzin, gr. 5–10 ..... .3–.6 Gm.
Phytolaccin, gr. 2–3 ..... .13–.2 Gm.
Piliganine hydrochloride, gr. $\frac{1}{6}$–$\frac{1}{3}$. .01–.02 Gm.
Potassium cobalto-nitrite, gr. $\frac{1}{2}$ .. .03 Gm.
Potassium osmate, gr. $\frac{1}{64}$ ..... .001 Gm.
Propylamine, gr. 30–60 ..... 2–4 Gm.
Pyoktanin, gr. 1–5 ..... .06–.3 Gm.
Pyrazol, gr. 15–30 ..... 1–2 Gm.
Pyridine, ♏j–3 ..... .06–.2 Cc.
Quinine arsenite, gr. $\frac{1}{12}$–$\frac{1}{2}$ .. .005–.03 Gm.
Quinine salicylate, gr. 1–8 .... .06–.5 Gm.
Quinine tannate, gr. 3–8 ..... .2–.5 Gm.
Retinol, gr. 1 ..... .06 Gm.
Rubidium ammonium bromide, gr. 15–20. 1–1.3 Gm.
Rubidium iodide, gr. 1–2 .... .06–.13 Gm.
Salicylamide, gr. 2–5 ..... .13–.3 Gm.
Santoninoxime, gr. 1–2 ..... .06–.13 Gm.
Scillain, gr. $\frac{1}{6}$–$\frac{3}{4}$ ..... .01–.05 Gm.
Scillipicrin, gr. $\frac{1}{60}$ ..... .001 Gm.
Sodium anisate, gr. 10–15 ..... .6–1 Gm.
Sodium di-thio-salicylate, gr. 3 .... .2 Gm.
Sodium para-cresotate, gr. 30–90. 2–6 Gm.
Sodium sulfo-caffeate, gr. 15 ..... 1 Gm.
Solanine, gr. $\frac{1}{8}$–1 ..... .01–.06 Gm.
Somatose, ʒss–8 ..... 2–30 Gm.
Sulphaminol, gr. 2–4 ..... .13–.26 Gm.
Tartar-lithine, gr. 5–10 ..... .3–.6 Gm.
Tartar-lithine and sulphur, gr. 5–10. .3–.6 Gm.
Terpinol, gr. 5–15 ..... .3–1 Gm.
Thalline tartrate, gr. 2–8 ..... .13–.5 Gm.
Thermifugin, gr. 1–4 ..... .06–.26 Gm.
Thermodin, gr. 5–15 ..... .3–1 Gm.
Thiol, gr. 2–10 ..... .13–.6 Gm.
Thymacetin, gr. 3–10 ..... .2–.6 Gm.
Tolypyrine, gr. 8–30 ..... .5–2 Gm.
Tolysal, gr. 15–30 ..... 1–2 Gm.
Tussol, gr. 2–8 ..... .13–.5 Gm.
Uropherin, gr. 10–15 ..... .6–1 Gm.
Vieirin, gr. 1–3 ..... .06–.2 Gm.

TABLE SHOWING THE NUMBER OF DROPS IN A FLUIDRACHM OF VARIOUS LIQUIDS WITH THE WEIGHT OF ONE FLUIDRACHM OF EACH IN GRAINS AND IN GRAMMES.

	Drops in fʒj. (60 m.)	Weight of fʒj in	
		grains.	grammes.
Acetum opii	90	61	3.95
Acetum sanguinariæ	78	55½	3.59
Acetum scillæ	68	57	3.69
Acidum aceticum	108	58	3.75
Acidum aceticum dilutum	68	55	3.56
Acidum hydrochloricum	70	65	4.21
Acidum hydrochloricum dilutum	60	56	3.62
Acidum hydrocyanicum dilutum	45	54	3.49
Acidum lacticum	111	66	4.27
Acidum nitricum	102	77	4.98
Acidum nitricum dilutum	60	58	3.62
Acidum nitrohydrochloricum	76	66	4.27
Acidum phosphoricum dilutum	59	57	3.69
Acidum sulphuricum	128	101	6.54
Acidum sulphuricum aromaticum	146	53	3.43
Acidum sulphuricum dilutum	60	58½	3.79
Acidum sulphurosum	59	55	3.56
Æther fortior	176	39	2.52
Alcohol	146	44	2.85
Alcohol dilutum	137	49	3.17
Aqua	60	55	3.56
Aqua ammoniæ fortior	66	50	3.24
Balsamum peruvianum	101	60	3.88
Bromum	250	165	10.69
Chloroformum purificatum	250	80	5.18
Copaiba	110	51	3.30
Creosote	122	56½	3.66
Fluidextractum belladonnæ	156	57	3.69
Fluidextractum buchu	150	47½	3.07
Fluidextractum cinchonæ	138	58	3.75
Fluidextractum colchici radicis	160	57	3.69
Fluidextractum colchici seminis	158	55	3.56
Fluidextractum conii fructus	137	61	3.93
Fluidextractum digitalis	134	62	4.01
Fluidextractum ergotæ	133	60	3.88
Fluidextractum gelsemii	149	49	3.14
Fluidextractum glycyrrhizæ	133	61	3.95
Fluidextractum hyoscyami	160	59	3.82

	Drops in f℥j. (60 m.)	Weight of f℥j in	
		grains.	grammes.
Fluidextractum ipecacuanhæ	120	60	3.88
Fluidextractum pareiræ	140	57	3.72
Fluidextractum rhei	158	61	3.95
Fluidextractum sarsaparillæ compositum	134	60	3.88
Fluidextractum senegæ	137	62	4.01
Fluidextractum serpentariæ	148	47	3.07
Fluidextractum uvæ-ursi	137	60	3.88
Fluidextractum valerianæ	150	49	3.17
Fluidextractum veratri	150	50	3.24
Fluidextractum zingiberis	142	48	3.11
Glycerinum	67	68	4.40
Hydrargyrum	150	760	49.24
Liquor acidi arsenosi	57	55	3.56
Liquor ammonii acetatis	75	56	3.62
Liquor arseni et hydrargyri iodidi	58	55	3.56
Liquor ferri chloridi	71	72	4.66
Liquor ferri citratis	71	72	4.66
Liquor ferri nitratis	59	59	3.82
Liquor ferri subsulphatis	73	83	5.37
Liquor ferri tersulphatis	83	72	4.66
Liquor hydrargyri nitratis	131	123	7.97
Liquor iodi compositus	63	59	3.82
Liquor plumbi subacetatis	74	70	4.53
Liquor potassii hydroxidi	62	58	3.75
Liquor potassii arsenitis	57	55	3.56
Liquor sodæ chlorinatæ	63	62	4.01
Liquor zinci chloridi	89	88	5.70
Oleoresina aspidii	130	52	3.36
Oleoresina capsici	120	51	3.30
Oleoresina cubebæ	123	52	3.36
Oleum æthereum	125	50	3.24
Oleum amygdalæ amaræ	115	55	3.56
Oleum amygdalæ expressum	108	48½	3.14
Oleum anisi	119	54	3.49
Oleum aurantii corticis	120	54	3.49
Oleum bergamottæ	130	46	2.98
Oleum cari	132	50	3.24
Oleum caryophylli	130	57	3.69
Oleum chenopodii	97	50	3.24
Oleum cinnamomi	126	53⅓	3.46
Oleum copaibæ	123	49½	3.20
Oleum cubebæ	125	51	3.30
Oleum fœniculi	125	53	3.43
Oleum gaultheriæ	125	62	4.01
Oleum juniperi	148	49	3.17
Oleum lavandulæ florum	138	52	3.36
Oleum limonis	129	47	3.04
Oleum menthæ piperitæ	129	50	3.24
Oleum olivæ	76	51	3.33
Oleum ricini	77	51½	3.33
Oleum rosæ	132	47	3.04
Oleum rosmarini	143	50	3.24
Oleum sabinæ	102	54	3.49
Oleum sassafras	133	58	3.75
Oleum terebinthinæ	136	45½	2.94
Oleum tiglii	104	50	3.24
Phenol (acidum carbolicum)	111	59	3.82
Spiritus ætheris compositus	148	45	2.91
Spiritus ætheris nitrosi	146	47	3.04
Spiritus ammoniæ aromaticus	142	48	3.11
Spiritus camphoræ	143	47	3.04
Spiritus chloroformi	150	48	3.11
Spiritus menthæ piperitæ	142	47	3.04

	Drops in f3j. (60 m.)	Weight of f3j in	
		grains.	grammes
Syrupus acaciæ	44	73	4.73
Syrupus ferri iodidi	65	77	4.98
Syrupus scillæ	75	74	4.79
Syrupus scillæ compositus	102	70	4.53
Syrupus senegæ	106	70	4.53
Syrupus simplex	65	72	4.66
Tinctura aconiti	146	46	2.98
Tinctura asafœtidæ	120	54	3.49
Tinctura belladonnæ foliorum	137	53	3.43
Tinctura benzoini composita	148	48	3.11
Tinctura cantharidis	131	51	3.33
Tinctura cinchonæ composita	140	49	3.17
Tinctura digitalis	128	53	3.43
Tinctura ferri chloridi	150	53	3.43
Tinctura guaiaci	130	46	2.98
Tinctura iodi	148	47	3.04
Tinctura nucis vomicæ	140	44	2.85
Tinctura opii	130	53	3.43
Tinctura opii camphorata	130	52	3.36
Tinctura opii deodorata	110	54	3.49
Tinctura tolutana	130	46	2.98
Tinctura valerianæ	130	52	2.36
Tinctura veratrum viride	145	46	2.98
Tinctura zingiberis	144	46	2.98
Vinum antimonii	72	50	3.24
Vinum colchici radicis	107	55	3.56
Vinum colchici seminis	111	54	3.49
Vinum opii	100	55	3.56

TABLE OF THERMOMETRIC EQUIVALENTS.

(Fahrenheit and Centigrade Scales.)

F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.
212	= 100	174	= 79	136	= 58	99	= 37	61	= 16	23	= — 5
210	= 99	172	= 78	135	= 57	97	= 36	59	= 15	21	= — 6
208	= 98	171	= 77	133	= 56	95	= 35	57	= 14	19	= — 7
207	= 97	169	= 76	131	= 55	93	= 34	55	= 13	18	= — 8
205	= 96	167	= 75	129	= 54	91	= 33	54	= 12	16	= — 9
203	= 95	165	= 74	127	= 53	90	= 32	52	= 11	14	= —10
201	= 94	153	= 73	126	= 52	88	= 31	50	= 10	12	= —11
199	= 93	162	= 72	124	= 51	86	= 30	48	= 9	10	= —12
198	= 92	160	= 71	122	= 50	84	= 29	46	= 8	9	= —13
196	= 91	158	= 70	120	= 49	82	= 28	45	= 7	7	= —14
194	= 90	156	= 69	118	= 48	81	= 27	43	= 6	5	= —15
192	= 89	154	= 68	117	= 47	79	= 26	41	= 5	3	= —16
190	= 88	153	= 67	115	= 46	77	= 25	39	= 4	1	= —17
189	= 87	151	= 66	113	= 45	75	= 24	37	= 3	— 1	= —18
187	= 86	149	= 65	111	= 44	73	= 23	36	= 2	— 2	= —19
185	= 85	147	= 64	109	= 43	72	= 22	34	= 1	— 4	= —20
183	= 84	145	= 63	108	= 42	70	= 21	32	= 0	—11	= —24
181	= 83	144	= 62	107	= 41	68	= 20	30	= —1	—31	= —35
180	= 82	142	= 61	104	= 40	66	= 19	28	= —2	—35	= —37
178	= 81	140	= 60	102	= 39	64	= 18	27	= —3	—40	= —40
176	= 80	138	= 59	100	= 38	63	= 17	25	= —4		

To convert Fahrenheit to Centigrade, subtract 32, multiply by 5, and divide by 9.
To convert Centigrade to Fahrenheit, multiply by 9, divide by 5, and add 32.

Popular Medical Abbreviations.

āā.	Ana	Of each.
Abs. febr.	Absente febre	Fever being absent.
Acet.	Acetum.	Vinegar.
Ad.	Adde	Add up to.
Ad 2 vic.	Ad duas vices	At two doses.
Ad sec. vic.	Ad secundum vicem	For twice.
Ad ter vic.	Ad tertiam vicem	For thrice.
Ad lib.	Ad libitum	At pleasure.
Ad us.	Ad usum	According to custom.
Adst. febre	Adstante febre	Fever present.
Aeq.	Æquales	Equal.
Agit. vas.	Agitato vase	Shaking the vial.
Aliq.	Aliquot	Some, a few.
Alt. hor.	Alternis horis	Every other hour.
Alv. adst.	Alvo adstricta	Bowels confined.
Ampul.	Ampulla	A small bottle (phial).
Aq.	Aqua	Water.
Aq. astr.	Aqua astricta	Frozen water.
Aq. bull.	Aqua bulliens	Boiling water.
Aq. comm.	Aqua communis	Common water.
Aq. ferv.	Aqua fervens	Hot water.
Aq. fluv.	Aqua fluvialis (fluviatilis)	River water.
Aq. font.	Aqua fontalis (fontana)	Spring water.
Aq. lac.	Aqua lacalis	Lake water.
Aq. mar.	Aqua marina	Sea water.
Aq. niv.	Aqua nivalis	Snow water.
Aq. pluv.	Aqua pluvialis (pluviatilis)	Rain water.
Aut	Aut	Or.
Bals.	Balsamum	Balsam.
Bib.	Bibe	Drink.
Bid.	Biduum	Two days.
Bis	Bis	Twice.
Bis in d.	Bis in die (indies)	Twice daily.
Bis in 7 d.	Bis in septum diebus.	Twice a week.
Bol.	Bolus	A large pill.
Bull.	Bulliat (bulliant)	Let boil.
But.	Butyrum	Butter.
C.	Cum	With.
C. m.	Cras mane	To-morrow morning.
C. m. s.	Cras mane sumendus	Take to-morrow morning.
C. n.	Cras nocte	To-morrow night.
C. v.	Cras vespere	To-morrow evening.
Cærul.	Cæruleus	Blue.
Cal.	Calomelas	Calomel.
Cap.	Capiat (Cape)	Let him (her) take.
Cap.	Capsula	A capsule.
Catapl.	Cataplasma	Cataplasm.
Caute	Caute	Cautiously.
Cerat.	Ceratum	Cerate.
Chart.	Charta	Paper.
Chartul.	Chartula	Small paper.
Cib.	Cibus	Food.
Coch.	Cochleare	A spoonful.
Coch. ampl.	Cochleare amplum	A tablespoonful.
Coch. infant.	Cochleare infantis	A teaspoonful.
Coch. mag.	Cochleare magnum	A tablespoonful.
Coch. mod.	Cochleare modicum	A dessertspoonful.
Coch. parv.	Cochleare parvum	A teaspoonful.
Coct.	Coctio	Boiling.
Col.	Cola	Strain.
Colatur.	Colaturæ	To the strained liquor.
Collod.	Collodium	Collodion.
Collut.	Collutorium	A mouth wash.

Collyr., coll.	Collyrium	An eye wash.
Comp.	Compositus	Compound, compounded.
Con., concis.	Concisus	Cut.
Conf., Confect.	Confectio	Confection.
Contin.	Continueter	Let it be continued.
Cont. rem.	Continuantur remedia	Let medicines be continued.
Coq.	Coque, coquantur	Boil.
Cort.	Cortex	The bark.
Crast., cras.	Crastinus	To-morrow.
Crast.	Crastinus (cras)	Early to-morrow.
Cuj.	Cujus	Of which.
Curat.	Curatio	Dressing.
Cyath.	Cyathus	A glassful.
Cyatho theæ	Cyatho theæ	In a cup of tea.
Cyath. (c.) vinar.	Cyathus vinarius	A wineglassful.
D.	Dosis	A dose.
De d. in d.	De die in diem	From day to day.
D., det.	Da, detur	Give; let it be given.
De	De	Of or from.
Deaur. pil.	Deaurentur pilulæ	Let the pills be gilded.
Deb. spiss.	Debita spissitudo	A proper consistence.
Dec.	Decanta	Pour off.
Decim.	Decimus	Ten, the tenth.
Decoct.	Decoctum	A decoction.
Deglut.	Deglutiatur	Let it be swallowed.
Dentif.	Dentifricium.	Dentifrice.
Dentilin.	Dentilinimentum	Dental liniment.
D. t. d. No. 4.	Dentur tales doses No. 4.	Take 4 such doses.
Dieb. alt.	Diebus alternis	On alternate days.
Dieb. tert.	Diebus tertiis	Every third day.
Dil.	Dilue, dilutus	Dilute, diluted.
Dim.	Dimidius	One-half.
Disp.	Dispensa, dispensetur	Dispense, let it be dispensed.
D. D. or direc. prop.	Directione propriâ	With proper direction.
D. in p. æq.	Dividatur in partes æquales	Divide in equal parts.
Div., divid.	Dividendus	Divide, to be divided.
Don.	Donec	Until.
Dur. dolor.	Durante dolore	During the pain.
Ead.	Eadem	The same.
Elect.	Electuarium	An electuary.
Elix.	Elixir, elexira	Elixir.
Emp.	Emplastrum	Plaster.
Emuls.	Emulsum	Emulsion.
En., enem.	Enema (enemata)	An enema, a clyster.
Et	Et	And.
Exhib.	Exhibeatur	Let it be exhibited.
Ext.	Extende (extendatur)	Spread.
Ext(r).	Extractum	An extract.
F., Ft.	Fac, fiat, fiant	Make, let it be made.
F. ft. pil. 12	Fac pilulas duodecim	Make 12 pills.
Far.	Farina	Flour.
Feb. dur.	Febre durante	During the fever.
Ferv.	Fervens	Boiling.
F. (Ft.) cataplasm	Fiat cataplasma	Make a poultice.
Ft. cerat.	Fiat ceratum	Make a cerate.
Ft. chart. 12	Fiant chartulæ duodecim	Make 12 powders.
Ft. collyr.	Fiat collyrium	Make an eye wash.
Ft. confec.	Fiat confectio	Make a confection.
Ft. elect.	Fiat electuarium	Make an electuary.
Ft. emp. 3 x 6	Fiat emplastrum 3 x 6	Make a plaster 3 x 6 inches.
Ft. emuls.	Fiat emulsio	Make an emulsion.
Ft. garg.	Fiat gargarisma	Make a gargle.
Ft. h. (haust.)	Fiat haustus	Make a draught.
Ft. infus.	Fiat infusum	Make an infusion.

Ft. inject.	Fiat injectio	Make an injection.
Ft. m. (mist.)	Fiat mistura	Make a mixture.
Ft. pil.	Fiat pilula	Make a pill.
F. L. A.	Fiat lege artis	Make by rules of art.
Ft. linim.	Fiat linimentum	Make a liniment.
Ft. (mas.) massa.	Fiat massa	Make a mass.
Ft. mas. div. in pil. 12	Fiat massa in pilulas duodecim dividenda	Make 12 pills.
Ft. pulv.	Fiat pulvis	Make a powder.
Ft. pulv. et div. in chart. 12.		Make 12 powders.
Ft. solut.	Fiat solutio	Make a solution.
Ft. suppos. 4	Fiant suppositora quatuor	Make 4 suppositories.
Ft. troch. 12	Fiat trochisci duodecim	Make 12 lozenges.
Ft. ung.	Fiat unguentum	Make an ointment.
Filtra.	Filtram	Filter (thou), a filter.
Fl., Fld.	Fluidus	Liquid.
Fldext.	Fluidextractum	Fluidextract.
Fldglycer.	Fluidglyceratum.	Fluidglycerate.
Form.	Formula	A prescription.
Garg.	Gargarisma	A gargle.
Glycer.	Glyceritum	Glycerite.
Glycerogel.	Glycerogelatinum	Glycerogelatin.
Gr.	Granum, Grana	Grain, grains.
Grat.	Gratus	Pleasant.
Gtt.	Gutta, guttæ	A drop, drops.
Guttat.	Guttatim	By drops.
Habt.	Habeat	Let him have.
Haust.	Haustus	A draught.
H.	Hora	An hour.
H. s. (hor. som.)	Hora somni	Before going to sleep.
H. d.	Hora decubitus	Hour of retiring.
Hor. interm.	Horis intermediis	At intermediate hours.
Ind.	In dies (indies)	Daily.
Inf.	Infunde	Pour in.
In(fus).	Infusum	An infusion.
Injec.	Injectio	An injection.
Int.	Internus	Inner, internal.
Inunct.	Inunctum	Inunction.
Jent.	Jentaculum	Breakfast.
Jux.	Juxta (juxtim)	Near to.
Kali ppt.	Kali præparatum	Prepared kali = K_2CO_3.
Lac.	Lactis	Milk.
Lat. dol.	Lateri dolenti	To the painful side.
Lavat.	Lavatio	Wash.
Lin.	Linimentum	A liniment.
Liq.	Liquor	A solution.
Lot.	Lotio	A lotion, wash.
Mac.	Macera	Macerate.
Mag.	Magnus	Large.
M., man.	Manipulus	A handful.
Manus	Manus	The hand.
Mas., mass	Massa (pilularis)	A mass—a pill mass.
Mel	Mel	Honey.
Mensur., mens.	Mensura	By measure.
Mic. pan.	Mica panis	Crumb of bread.
M., min.	Minimum	A minim.
Minut.	Minutum	A minute.
M.	Misce	Mix.
Mist.	Mistura	A mixture.
Mitte.	Mittatur	Send, let it be sent.
Mit. tal.	Mitte talis	Send of such like.
Mod. præsc.	Modo præscripto	In manner prescribed.
More dict.	More dictu	In manner directed.
Mucil.	Mucilago	Mucilage.

Mull.	Mulla	Mull.
Nebul.	Nebula	Spray.
Non	Non	Not.
Non repetat.	Non repetatur	Let it not be repeated.
No.	Numerus (numero)	Number.
N. a.		Numerical aperture.
N. F.		National Formulary.
O.	Octarius	A pint.
Odontalg.	Odontalgicum	Toothache remedy.
Oleat.	Oleatum	Oleate.
Oleores.	Oleoresina	Oleoresin.
Ol.	Oleum	Oil.
Ol. Inf.	Olea Infusa	Infused oils.
Omn. hor.	Omni hora	Every hour.
O. m.	Omni mane	Every morning.
Omn. bih.	Omni bihora	Every two hours.
O. n.	Omni nocti	Every night.
P. æq.	Partes æquales	Equal parts.
Part. vic.	Partitis vicibus	In divided doses.
P., pt.	Perstetur	Continue.
Pas., pastil.	Pastillum, pastillus	A small lozenge.
Past.	Pasta	Paste.
Penicil. cam.	Penicillum camelinum	Camel's hair pencil.
Petrox.	Petroxolinum	Petroxolin.
P. P. A.	Phiala prius agitata	First shaking the bottle.
Pil.	Pilula	A pill.
Pocul., pocill., poc.	Poculum, pocillum	A cup, a little cup.
P.	Pondere	By weight.
Pone aur.	Pone aurem	Behind the ear.
Pot.	Potus	Drink.
Præp.	Præparat(us)-a	Prepared.
Prand.	Prandium	Dinner.
Prim. man.	Primo mane	Early in the morning.
Pro rat. æt.	Pro ratione ætatis	According to the age of the patient.
P. r. n.	Pro re nata	When necessary.
Pug.	Pugillus	A pinch.
Pulv.	Pulvis, pulverizatus	A powder, powdered.
Pyx.	Pyxis	A pill box.
Q. l.	Quantum libet	As much as is required.
Q. p.	Quantum placet	As much as is required.
Q. v.	Quantum vis, volueris	As much as is required.
Q. s.	Quantum sufficit	A sufficient quantity.
Qq. hor.	Quaqua hora	Each, every hour.
Q. q.	Quoque, quaque	Also—each, every.
Rec.	Recens	Fresh.
℞.	Recipe	Take.
Rept.	Repetatur	Let it be repeated.
Scat.	Scatula	A box.
S. a.	Secundum artem	According to art.
S. n.	Secundum naturam	According to nature.
Ss.	Semis	A half.
Semih.	Semihora	Half an hour.
Sesqh.	Sesquihora	An hour and a half.
Sig.	Signa	Mark thou, sign.
Sing.	Singulorum	Of each.
Si n. val.	Si non valent	If it does not answer.
Si op. sit.	Si opus sit	If necessary.
Solv.	Solve, solvetur	Dissolve.
Stat.	Statim	Immediately.
St.	Stet, stent	Let it stand.
S. s. s.	Stratum superstratum	Layer upon layer.
Sum.	Sume, sumat sumendus	Take, let it be taken.
Summit.	Summitates	The summits, tops.

Sup.	Super, supra	Above.
Syr.	Syrupus	Syrup.
Tab.	Tabellæ	Tablets.
Tal.	Talis	Such, like this.
T. i. d. or t. d.	Ter (in) die	Three times a day.
Tinct., tr.	Tinctura	Tincture.
Trit.	Tritura	Triturate.
Troch.	Trochisci	Troches, lozenges.
Ter.	Tere	Rub.
Ter. bene	Tere bene	Rub well.
Ult. præsc.	Ultimo præscriptus	The last ordered.
Una	Una	Together.
Ung.	Unguentum	Ointment.
Unc.	Uncia	An ounce.
Utend.	Utendum	To be used.
Ut. Dict.	Ut dictum	As directed.
U. S. P.		United States Pharmacopœia.
Vehic.	Vehiculum	A vehicle.
Vel	Vel	Or.
Vesp.	Vesper, vesperis	The evening.
Vom. urg.	Vomitione urgente	The vomiting being troublesome.

Some Leading Organic Drugs whose Medicinal Properties Depend upon One or More Specific Constituents.

1. *Sugar.*

Fig, Honey, Manna, Prune, Triticum.

2. *Sugar + Acid.*

Cassia Fistula, Lemon Juice, Phytolacca Fruit, Raspberry, Tamarind, Rhus Glabra.

3. *Mucilage.*

Althea, Cetraria, Chondrus, Elm, Sassafras Pith, Acacia, Tragacanth.

4. *Volatile Oil.*

Anise (1–3 p. c.), Buchu (1–1.6 p. c.), Calamus (1–3.5 p. c.), Caraway (5–7 p. c.), Cardamom Seed (5 p. c.), Cascarilla (1.6 p. c.), Chenopodium (3–3½ p. c.), Cinnamon (½–2 p. c.), Clove (18 p. c.), Coriander (½–1 p. c.), Cubeb (5–15 p. c.), Eriodictyon, Eucalyptus (6 p. c.), Fennel (2–6 p. c.), Garlic (¼ p. c.), Ginger (1–3 p. c.), Hedeoma (1 p. c.), Illicium (2–5 p. c.), Lemon Peel (2 p. c.), Mace (8 p. c.), Marrubium, Melissa (¼ p. c.), Mustard, Nutmeg (2–8 p. c.), Orange Peel (Bitter), Orange Peel (Sweet), Pepper (1–2 p. c.), Peppermint (1 p. c.), Pimenta (3–4 p. c.), Rose Pale, Rose Red (.05 p. c.), Saffron (1 p. c.), Salvia (½–2 p. c.), Sambucus, Sassafras (6–9 p. c.), Scutellaria, Spearmint (½ p. c.), Sumbul (½–1 p. c.), Tansy (¼ p. c.), Valerian, Vanilla (½–2 p. c.).

5. *Concrete Volatile Oil.*

Camphor, Menthol, Thymol.

6. *Resin.*

Guaiac, Mastic, Rosin, Aspidium, Cascara Sagrada, Caulophyllum, Cimicifuga, Cottonroot Bark, Frangula, Ipomea, Jalap, Kamala, Podophyllum, Pulsatilla, Pumpkin Seed, Stillingia.

7. *Oleoresin.*

Copaiba (oil, 20–90 p. c.), Turpentine (oil, 20–30 p. c.), Turpentine Canada (oil, 24 p. c.), Burgundy Pitch, Pine Tar.

8. *Gumresin.*

Gamboge (gum, 16–25 p. c., resin, 66–80 p. c.), Scammony (gum, 3–8 p. c., resin, 75–90 p. c.), India Rubber (resin, 32 p. c.).

9. *Gum, Resin, + Volatile Oil.*

Ammoniac (gum, 18–28 p. c., resin, 70 p. c., vol. oil, 1–4 p. c.), Asafetida (gum, 20–30 p. c., resin, 60–70 p. c., vol. oil, 6–9 p. c.), Myrrh (gum, 40–60 p. c., resin, 25–40 p. c., vol. oil, 4–8 p. c.).

10. *Balsam.*

Benzoin (benzoic acid, 10–20 p. c.), Balsam of Peru (resin, 16–25 p. c., cinnamein, 56–66 p. c.), Tolu (vol. oil, 1 p. c.), Storax.

11. *Volatile Oil (Resin) + Bitter Principle.*

Absinthium, Arnica, Asclepias, Cannabis, Chamomile, Cusso, Cypripedium, Grindelia, Hamamelis, Inula, Iris, Lappa, Lupulin, Matico, Matricaria, Mezereum, Phytolacca Root, Pyrethrum, Serpentaria, Xanthoxylum.

12. *Fixed Oil* +.

Aspidium, Cottonroot Bark, Flaxseed, Lycopodium, Pumpkin Seed, Pyrethrum, Stillingia, Sweet Almond, Vanilla.

13. *Tannic or Gallic Acid.*

Castanea, Catechu, Gambir, Geranium, Hæmatoxylon, Kino, Krameria, Nutgall, Rubus, Rumex, White Oak, Wild Cherry.

14. *Glucoside.*

Aloe, Apocynum, Araroba, Bryonia, Calendula, Calumba, Capsicum, Cascarilla, Caulophyllum, Cetraria, Chimaphila, Chirata, Clove, Colocynth, Convallaria, Corn Silk, Cubeb, Digitalis, Dulcamara, Ergot, Euonymus, Eupatorium, Frangula, Glycyrrhiza, Guarana, Juglans, Kamala, Leptandra, Phytolacca, Quassia, Quillaja, Rhubarb, Rhus Toxicodendron, Santonica, Sarsaparilla, Senega, Senna, Squill, Strophanthus, Taraxacum, Uva Ursi, Vanilla, Viburnum Prunifolium, Wild Cherry.

15. *Alkaloid.*

Aconite, Aspidosperma, Belladonna, Calumba, Chelidonium, Cinchona, Coca, Colchicum, Conium, Gelsemium, Guarana, Hop, Hydrastis, Hyoscyamus, Ipecac, Lobelia, Menispermum, Nux Vomica, Opium, Pareira, Pepper, Physostigma, Pilocarpus, Pomegranate, Sanguinaria, Scoparius, Spigelia, Staphisagria, Stramonium, Tobacco, Veratrum viride.

The Pronunciation of Some Important Words Used in this Work.

Ab-i-et'ic.
Ab'i-e-tin.
A-bras'tol.
Ab'rin.
Ac-et-an'i-lid(e)–(As).
Ac-e-to-phe'none.
Ach-il-le'ine.
Ad-on'id-in.
Ad-ren'a-lin.
A'gar-a'gar.
A-gar'i-cin.
Ag'a-thin.
A-lan'tol.
Al-cor-no'que (ka).
A-liz'a-rin (Al-i-za'rin).
Am'pul.
A-myg'da-lin.
An-drom-e-do-tox'in.
An-e-mon'ic.
A-nem-o-nin'ic.
An'e-thol.
An-them'ene.
An-them'ic.
An-them'i-din.
An-them'ol.
An-thra-ro'bin.
An-ti-py'rine.
A'pi-in.
Ap'i-ol.
Ap-i-ol'ic.
Ap-i-ol'in.
Ap-o-at'ro-pine.
A-poc-y-ne'in
(A-po-cyn'e-in).
A-poc'y-nin—(pos').
Ap-o-ret'in.
Ar'a-chin.
Ar'bu-tin.
Ar-gyr'i-a.
Ar'gy-rol.
Ar'is-tol.
Ars-phen'am-ine.
Ar-tem'i-sin.
As'a-prol.
As-cle-pi'a-din
(As-cle-pi-a'din).
A-sel'line.
A-sep'tol.
As-pi-di-nol'fi-liz'inol.
As-pid-os'a-mine.
As-pid-o-sper'ma-tine.
As-pid-o-sper'mine.
A-tro-pa'mine.
A-tro-pur-pu'rin.
At'ro-sin.

Bal-sam-i'to.
Bar'bi-tal.
Bas'so-rin.
Bdel'li-um—(Del').
Ben-zac'o-nine.
Benz-al'co-hol.
Ben-zan'i-lide.
Ber-ga'mi-ol.
Ber-gap'tene.
Be'ta-ine.
Be'tol.
Bil-i-neu'rine.
Bil-i-ru'bin.
Bor'ne-al.
Bry-oi'din.

Cab'al-line.
Cac-o-dyl'ate.
Caf-fe'id-ine.
Caj'e-pu-tol.
Cal-a-bar'ine.
Caout'chouc (Koo'chook).
Cap-ron'ic.
Ca-pryl'ic.
Cap-sa'i-cin.
Cap'si-cine.
Ca-ra'cas.
Car-min'ic.
Car-nau'bic.
Car-ra-gee'nin.
Car'ra-gen.
Car'tha-mine.
Car-y-o-phyl'lene.
Car-y-o-phyl'lin.
Ce-dra'rine.
Ceph-a-e'line.
Ce-rot'ic.
Ce-ryl'ic.
Ce-trar'ic.
Ce-tra'rin (Cet'ra-rin).
Ce-tyl'ic.
Cev-a-dil'lic.
Cev'a-dine.
Chav-'i-cin.
Chav'i-col.
Chel-e-ryth'rine.
Chel-id'o-nine.
Chel-i-do-xan'thine.
Chi-maph'i-lin.
Chi-na-phen'ine.
Chi-noid'ine.
Chi-rat'in.
Cho-lal'ic.
Chol-e-pyr'rhin.
Cho-les'ter.
Chol'ic.
Chlo'ral-ose.
Chlor-am'ine.
Chry-sat'ro-pic
(Chrys-a-trop'ic).
Chrys'o-phan.
Chrys-o-phan'ic.
Cim-i-cif'u-gin.
Cin-chon'i-cine.
Cin-chon-i-di'na.
Cin-chon'i-dine.
Cin-cho-ni'na.

Cin'cho-nine—(Sin').
Cit'rine.
Cit-ron-el'lal.
Col-chic'e-in.
Col-chi-co-res'in.
Col-o-cyn-the'in.
Col-o-cyn'the-tin.
Con-cus'co-nine.
Con'i-ce-ine.
Co-ni'ic.
Con-val-la-ma're-tin.
Con-val-la-ma'rin.
(Con-val-lam'a-rin).
Coñ-val-la-re'tin.
Con-val'la-rin.
Co-nyd'rine (Co-ny'drine).
Cor-dil-le'ra—(la').
Co-tar'nine.
Cou'ma-rin.
Cre'o-lin.
Cres'al-ol.
Cre'sol.
Cro'ce-tin.
Cu'pre-ine.
Cys'to-gen.

Daph'ne-tin.
Der'ma-tol.
Di-aph'the-rin.
Dig'a-lin.
Dig-i-tal-et'in.
Dig'i-tal-in.
Dig-i-tal-os'min.
Dig-i-to-flav'on.
Dig-i-to-le'ic.
Dig-it'o-nin.
Dig-i-toph'yl-lin.
Dig-i-tox'in.
Dig'it-sa'po-nin.
Di-pen'tene.
Di-u-re'tin.
Du-boi'sine.
Dul-ca-ma'rhe-tin
(Dul-ca-ma-rhet'in).
Dul-ca-ma'rin.
Du-o-de'num.

E-lat'e-rid.
El'e-mi.
El-em'ic.
El-e-op'tene.
El-lag'ic.
Em'e-tine.
Em'o-din.
Ep-i-neph'rine.
Er'ga-mine.
Er-go-chry'sin.
Er-go-ti'na.
Er'go-tine.
Er-go-tin'ic.
Er-got'i-nine.
Er'go-tol.
Er-go-tox'in.
E-ric'o-lin.
Er-i-o-dic-ty-on'ic.
E-ryth-ro-cen-tau'rin.
(Er-y-thro-cen-tau'rin).
E-ryth-ro-phlœ'ine.
(Er-y-thro-phlœ'ine).
E-ryth-ro-re'tin
(Er-y-thro-re'tin).
E-ser'a-mine.
E-ser'i-dine.
Eth'yl-ene.
E-thyl'i-dene.
Eu'ca-ine.
Eu'ge-nol.
Eu'ko-dal.
Eu'pho-rin.
Eu'ro-phen.
Ex-al'gin.

Fab-i-an'ine.
Fe-lic'ic—(lis').
Fer-u-la'ic.
Fer'u-lic.
Fer'u-lyl.
Fil'i-cin.
Fil-i-cin'ic.
Flu-id-glyc'e-ra'tum.
For-mal'de-hyde.
For'ma-mide.
For-man'i-lid.
Fran-gu-lin'ic.

Gal-lac-e-to-phe'none—
Gal-lan'i-lide. [(las).
Ge'lose.
Gel-se'mic.
Gel-se-min'ic.
Gel-se'mi-nine.
Gen-ti-an'ic.
Gen'ti-an-in.
Gen'ti-an-ose.
Gen-ti-o-pic'rin.
Gen-tis'ic.
Gi-tal'in.
Gl'tin.
Glu'cin.
Glu'side.
Glyc-e-ro-gel'a-ti'num.
Gly-co-chol'ic.
Gly'co-coll.
Glyc-yr-ram'a-rin.
Glyc-yr-rhet'in.
Glyc-yr-rhi'zic.
Glyc-yr-rhi'zin—(Glys)
(Gly-cyr'rhi-zin).
Guai-ac'ic—(as').
Guai'a-cin—(Gwi').
Guai'a-col.
Guai-a-con'ic.
Guai-a-ret'ic.
Gur-ju'nic.

Ha-ma-te'in.
Hash'ish.
Hel-le-bo-re'in.
Hel-le-bo-res'in.
Hel-le-bor-et'in.
Hep-ta-to'sane.
Hes-per'e-tin.
Hes-per'i-din.
Hex-a-meth'yl-en'a-mine.
Hol-o-ca'ine.
Ho-mat'ro-pine.
Ho-mo-quin'ine
(Ho-mo-qui-nine').
Hy-drac'e-tin—(dras').
Hy-dro-e-lat'e-rin.
Hy-dro-quin'ine.
Hy-dro-qui'none.
Hy-drox-yl'am-ine.
Hy-os'cine.
Hy-os-cy'a-mine.
Hy-os-cy-pic'rin.
Hy'o-sin.
Hy-poph'y-sis.

Ich'thy-ol.
In-fla'tin.
I'o-dol.
Ip-u-ran'ol.
I-so-a-myl'a-mine.

Je-co'le-ic.
Ju'ni-per-in.

Kryp'to-nine.

Lac-to-phen'in.
Lec'i-thin—(Les').
Li-chen'ic.
Li'chen-in.
Li-mo'nene.
Lo-be-lac'rin.
Lo-be'lic.
Lo'be-line.
Lo'so-phan.

Man-del'ic.
Man'ni-tan.
Mar-ru'bi-in.
Mas-tic'ic—(tis').
Mas'ti-cin.
Mel'i-tose.
Me-liz'i-tose.
Men'thene.
Men'thol.
Men-y-an'thin.
Met-a-co-pai'vic.
Meth-ac'e-tin—(as').
Meth-en'am-ine.
Meth'yl-al.
Methyl-am'ine.
Methyl-an'i-line.
Meth'yl-co-ni-ine.
Meth'yl-ene.
Methyl-sul'pho-nal.
Methyl-thi'o-nin.
Me-thys'ti-cin.
Mor'rhu-ine.
Mor'rhu-ol.
Mus'ca-rine (Mus-car'ine).
Myr'o-sin.

Myr-ox-o-car'pin.
Myr-rhe'nol.
Myr'rhol.

Nar'co-phin.
Neil-gher'ry—(Nel-ger'e).
Ne-o-ars-phen'am-ine.
Ne-o-sal'var-san.
Ni-co'ti-an-in—(ko'shi).
Nic'o-tine.
Nov-as'pi-rin.

Op'so-nin.
O-rex'ine-(sin).

Pal'len-in.
Pa-naq'ui-lon—(nak'wi).
Pap-a-yo'tin.
Pa-ral'de-hyde.
Par-ar'ab-in.
Pa'ri-cine.
Pa-rig'e-nin.
Pa-rig'lin.
Pay'tine.
Pel-le-tier'ine.
Pen'tal.
Pet'ro-se-line.
Pet-rox'o-li'num.
Phæ-o're-tin(Phæ-o-re'tin).
Phe-nac'e-tin—(nas').
Phe-net'i-din(e).
Phe-net'sol.
Phe'no-coll.
Phe-no-bar'bi-tal.
Phe-nol-phtal'ein.
Phe-nol-sul-phon-phthal'e-in
Phen-zo'line.
Phe'nyl-cin-cho-nin'ic.
Phlob'a-phene.
Phlo-ro-glu'cin.
Phy-set'o-le-in.
Phy-to-lac'ic—(las').
Phy-to-lac'cin—(lak'sin).
Phy-tos'ter-in.
Pic-rac'o-nine.
Pic-rac-on'i-tine.
Pi-lo-car'pi-dine.
Pi-per'a-zine.
Pi-per'i-dine.
Pip'e-rine.
Pip-er-o'nal.
Pod-o-phyl-lo-quer'ce-tin.
Pod-o-phyl-lo-tox'in.
Po-lyg'a-lite.
Pro-ca'ine.
Proph'e-tin.
Pros-en-chym'a-tous.
Pro-tar'gol.
Pseu-dac'o-nine.
Pseu-dac-on'i-tine.
Pseu-dac'o-rus.
Pseu-dat'ro-pine.
Psy-chot'rine.
Pur'pu-rin.
Py'ro-dine.
Pyr-o-guai'a-cin.

Que-bra'chine.
Quer'ce-tin.
Quer'cit-rin.
Quin-am'i-a.
Quin-am'i-cine.
Quin-a-mi'na.
Quin'ic.
Quin'i-cine.
Qui-ni-di'na.
Quin'id-ine.
Qui-ni'na.
Quin'ine—(Kwin').
(Qui'nine)—(Kwi').
Qui-no'vic.
Qui-no'vin.

Res-or'ci-nol.
Rham'ne-tin.
Rham-no-ca-thar'tin.
Rham-nox-an'thin.
Ri'cin.
Ric-in-e-la-id'ic.
Ri-cin'ic.
Ric-in-o'le-ic—(Ris).
Ric-in-o'le-in.
Ric-i-nol'ic.
Rot'tle-rin.
Ru-be-ryth'in.

Sal-ac'e-tol—(as').
Sal-an'tol.
Sa-lig'e-nin.
Sal-i-py'rine.
Sal-i-re'tin.
Sal'o-phen.
Sal'u-tol.
Sal've-ol.
Sa-pog'e-nin.
Sap'rol.
Sar'ko-sine.
Sar-sa-sap'o-nin.
Scam'mo-nin.
Scil'li-tin.
Scil-li-tox'in.
Scil-li-pic'rin.
Scle-ren-chym'a-tous.
Scler-o-crys'tal-lin.
Scler-oi'o-din.
Scler-o-mu'cin.
Scler-o-tin'ic.
Scler-ox-an'thin.
Sco-po'la-mine.
Scroph'u-la-rin.
Scu-tel'la-rin.
Scy-chelles.
Sen'nac-rol.
Sen-na-pic'rin.
Ses'a-min.
Sin-al'bin.
Sin'a-pine.
Sin'a-pic.
Sin'i-grin.
So-lan'i-dine.
Sol'a-nine.
So'zal.
So-zo-i'o-dol.
So-zo-i-o-dol'ic.
Staph-is-ag'rine.
Ste-a-rop'tene.
Sto-res'in.
Stro-phan'thi-din.
Styr'a-cin.
Sty'ro-lene.
Sulph-am'i-nol.
Sul'pho-nal.
Sul-phon-ethyl-meth'ane.
Sul-phon-meth'ane.
Su-pra-re'nal.
Su-pra-ren'a-lin.

Ta-rax-a'ce-rin.
Tau-ro-chol'ic.
Ter'pene.
Ter-pin'e-ol.
Ter'pin-ol.
Tet'ro-nal.
The-oph'yl-line.
The-rop'ic.
Thi'o-phene.
Thi-o-sin'a-min.
Thu-jig'e-nin.
Thym-ac'e-tin—(as').
Trag-a-can'thin.
Tre'ha-lose.
Tri-ni-tro-phe'nol.
Trig-o-nel'line.
Tri'o-nal.
Tro-pa-co'ca-ine.
Tro'pine.
Tu-li-pif'er-ine.

Um-bel-lif'e-ron.
U're-thane.
Ur'son.

Ver-a-tral'bine.
Ver-a-tram'a-rin.
Ver-a-troi'dine.

Xan'thin—(Zan').

INDEX.

A

Abbé condenser, 958, 959
Abbreviations, xii, 994–998
Aberration, chromatic, 957
  spherical, 958
Abies Abies, balsamea, canadensis, excelsa, Fraseri, Menziesii, pectinata, Picea, 82, 83
Abrastol, 944
Abrin, 319
Abrus precatorius, 319
Absinthe liqueur, 611
Absinthium, 611
Absorbent cotton, 400
Abstract, aconite, 206
  belladonna root, 539
  digitalis, 556
  hyoscyamus, 547
  jalap, 503
  nux vomica, 483
  podophyllum, 213
  senega, 371
  valerian, 597
Abstracts, abstracta, 24
Abutilon, 400
Acacia, Adamsonii, anthelmintica, Arabian (vera), bambolah, Barbary, Catechu, cortex, decurrens, Egyptian, Ehrenbergiana, Fistula, granulated (sanded), gummifera, Indian, Mogador, Morocco, nilotica, Persian, powdered (dusted), Senegal, Seyal, stenocarpa, Suma, tortilis, Turkey, Verek, 281, 282, 283, 284, 286, 287
Acetanilid, 904, 933
Acetannin, 871
Acetbromanilid, 933
Acetic ether, 879
Acetmethyl-anilid, 934
Acetol salicylate, 941
Acetone, 866, 922
Acetone-chloroform, 863
Acetophenone, 938
Acetozone, 922
Acetphenetidin, 934
Acetphetidin, 905
Acetum, aceta, 19
  aromaticum, 85
  cantharidini, 638
  lobeliæ, 608
  sanguinariæ, 250
Acethylamidobenzene, 904
Acetylmethylid, 866
Acetyl-para-amido-phenol-salicylate, 941
Acetyl-para-ethoxy-phenyl-urethane, 934
Acetyl-phenyl-hydrazine, 938
Achillea Millefolium, 624
Acid, acetic, 868, 923
  diluted, 869
  glacial, 870
  acetylsalicylic, 898, 940
  acetyltannic, 871
  aconitic, 205
  amido-succinic (succinamide), 398
  anhydro - orthosulphamidebenzoic, 906
  anisic, 942
  anthemic, 624
  arabic, 284
  arsenous, 831
  behemic, 253
  benzoic, 305, 469, 939
  boracic, 688
  boric, 688
  brassic, 253
  bromauric, 702, 839
  calumbic, 217
  camphoric, 232
  carbolic, 886
  liquid, 888
  carbozotic, 900
  carminic, 633
  caryophyllic, 427
  cephaëlic, 587
  chaulmoogric, 416
  chelidonic, chelidoninic, 251
  chinic, 574
  chlorhydric, 700
  chloroplatinic, 840
  chromic, 794
  chrysophanic, 181, 293, 296
  cinchonic, 574
  cincho-tannic, 574
  cinnamic, 259, 305, 470
  citric, 875
  coca-tannic, 337
  cresylic, 891, 928
  cubebic, 146
  diacetyltannic, 871
  diethylbarbituric, 882
  di-iodo-para-phenyl-sulphonic, 927
  di-iodo-salicylic, 939
  dioxysuccinic, 873

Acid, elaic, 871
ergotinic, ergotininic, 62
erucic, 253
ethyldene-lactic, 876
eugenic, 427, 931
filicic (filicinic), 69
filitannic, 69
flavaspidic, 69
formic, 643
gallic, 157
gummic, 284
hydnocarpic, 416
hydriodic, diluted, 716
hydrobromic, diluted, 702
hydrochloric, 700
diluted, 700
hydrocyanic, diluted, 721
hypophosphorous, 697
igasuric, 480, 482
ipecacuanhic, 586, 587
isolactic, 876
isolinoleic, 332
jecoleic, 645
jervic, 103, 251
kinic, 574
kino-tannic, 322
kinovic, 574
kramero-tannic, 301
lactic, 876, 923
linoleic, 332
linolinic, 332
lobelic, 607
malic, 538
marine, 700
meconic, 244
methyl-para-oxy-benzoic, 942
muriatic, 700
diluted, 700
nitric, dilute, 683
nitrophenisic, 900
oleic, 871
ortho-oxybenzoic, 896
ortho-phenol sulphonic, 927
oxalic, 874
oxylinoleic, 332
oxypropionic, 876
phenylcinchoninic, 908
phenylic, 886
phenyl-quinoline-carboxylic, 908
phosphoric, 696
diluted, 696
picric, 900
podophyllinic, 212
polyarabinantrigalactan-giddic, 313
polygalic, 371
pyrogallic, 932
pyroligneous, 870
quinic, 574
quino-tannic, 574
quinovic, 574
ratanhia-tannic, 301
salicylic, 896, 939
santalic, 320
santoninic, 610
sodium carbonate, 727
Acid, sozoiodolic, 927
sozolic, 927
stearic, 872
sulphuric, 692
aromatic, 693
diluted, 693
sulphurous, 694
tannic (tannin), 157, 423
tartaric, 873
therapic, 645
thymic, 518
tragacanthan-xylan-bassoric, 313
trichloracetic, 870, 923
valeric (valerianic), 596
vitriolic, 692
Acids, 686, 923
fatty dibasic, 873
monobasic, 868
tribasic, 875
Acidum nitricum dilutum, 683
nitrohydrochloricum, dilutum, 683
Acipenser Huso, 646
Aconine, 205, 206
Aconite (root), aconitum, Chinese, Japanese, 204, 208
Aconitine, Aconitina (Aconitia), 205
Aconitum, Anthora, cammarum (variegatum), columbianum, ferox, Fischeri, heterophyllum, japonicum, luridum, Lycoctonum, Napellus, neomontanum, Störckianum, uncinatum, variegatum, 204, 206, 208
Acorn cups, 160
Acorus Calamus, 101
Actæa racemosa, spicata, 202
Adalin, 703
Adeps, 650
lanæ, 655
Adiantum pedatum, 70
Adnephrin, 657
Adonidin, 199
Adonis vernalis, 199
Adrin, 657
Ægle Marmelos, 362
Ænas afer, 639
Æthusa Cynapium, 441
Affium, 239
Agar, agar-agar, 55, 646
Agaric of the Oak, 66
Agaricin, Agaricus; agaric, white (Larch), muscarius, 65, 66
Agathin, 939
Agathis loranthi folia (dammara), 83
Agathosma variabile, 342
Agave americana, 113
Agnin, 655
Agropyron æstivum, repens, 91, 98
Ague tree, 233
Ailanthus glandulosa, 294
Air, 18
Airoform, 930
Airogen, 930
Airol, 930
Ajowan, 519
Albizzia anthelmintica, 378

Albumen, 647
Albumin tannate, albumini tannas, 647
Albuminis tannas, (tannicum), 647
Albutannin, 647
Alcohol, 848, 919
amyl (amylic), 851
common, 848
dehydrated, 849
denatured, 919
diluted, 849
ethyl, 848, 919
methyl, 919
phenylic, 886
proligneous, 919
tertiary amyl, 920
wood, 919
Alcohols, 848
monatomic, 848
triatomic, 852
Alcornoque, 163
Aldehydes, 854, 938
Aletris farinosa, 117
Algæ, 49, 55
Alhagi camelorum, 475
Alizarine yellow, 938
Alkalies, 39
Alkermes, 634
All heal, 594
Allium, Cepa, Porrum, sativum, 116, 117
Allspice, 429
Allylguaiacol, 427
Allyl isothiocyanate (isosulphocyanate), 254
Allyl-sulpho-urea, 925
Allyl-thio-urea, 925
Almonds, Barbary, French, Jordan, Sicily, sweet, Valencia, 276, 279
Almug, 172
Aloe, American, Barbados, bitter, Bombay, Caballine, Cape, Capensis, Curaçao, E. India, ferox, glassy, hepatic, horse, lucida, India, Jefferabad, Moka (Mocha), Natal, Perryi, shining, Socotrine, vera, vulgaris, Zanzibar, 107, 112, 113, 114, 116
Aloe-emodin, 181
Aloin, barb-, Curaçao, socatrine, 114
Alpinia officinarum, 132
Alteratives, 39
Althæa, althea, altherin, officinalis, rosea, 397, 398, 399
Althein, 398
Alum, 771
burnt, 772
dried, 772
exsiccated, 772
Aluminum, 771
chloride, 772
hydroxide, 773
sulphate, 773
Amanita muscaria, 66
Amber, 83
Ambergris, 649
Ambra grisea, 649
American mandrake, 210
American spikenard, 435
Amido derivatives, 932
Amidopyrine, 909, 947
Amido-succinic (succinamide), acid, 398
Aminoform, 856
Ammonia, muriate, 747
Ammoniæ, Ammoniacum, African, cakes, tears, 454, 455
Ammonio-ferric citrate, 784
Ammonium, benzoate, bromide, carbonate, chloride, hypophosphite, iodide, nitrate, phosphate, salicylate, sulphate, valerate, 745, 746, 747, 749, 750, 751
Amomum Cardamomum, globosum, Granum-paradisi, maximum, verum, xanthoides, 138
Amorphous hyoscyamine, 545
Ampull-a, ampull-æ, ampuls, 22
Ampullæ caffeinæ sodio-benzoatis, 583
emetinæ hydrochloridi, 588
iodi, 704
quinine dihydrochloridi, 569
Amygdala, amara, 275
dulcis, 278
Amygdalin, 274, 276
Amygdalus amara, communis, Persica, 275, 280
Amyl nitrite, 881, 924
Amylene, 916
hydrate, 920
Amylum, 87
Amyridaceæ, 365
Amyrin, 368
Anacardiaceæ, 52, 384
Anacyclus officinarum, Pyrethrum, 625, 626
Analgen, 946
Analgesics, 40
Anamirta Cocculus, 218
Anaphrodisiacs, 45
Andropogon squarrosa (muricatus), 96
Anemone, coronaria, nemorosa, Nuttalliana, patens, quinquefolia, ranunculoides, sylvestris, vulgaris, 208, 209
Anemonin, 208, 210
Anesthesin, anesthesinum, 885, 943
Anesthetics, 41
Anesthone, 885
Anethi fructus, 449
Anethol, 444
Anethum graveolens, 449
Aneys, 443
Angelica Archangelica, European, 448
Angelim Amargosa, 324
Angiospermæ, 50, 87
Anhalonidine, 429
Anhalonium Lewinii, Williamsii, 420
Anhydro-gluco-chloral, 922
Anise, Anisum, Alicante, French, German, Italian, Russian, Spanish, star, 189, 443, 445
Aniseed, 443
Anodynes, 40
Anthelmintics, 45
Anthemene, Anthemidin, 624

Anthemic acid, 624
Anthemis, Cotula, nobilis, 624, 625
Anthraglucosennin, 296
Anthrarobin, 325, 944
Antidiphtheric globulins, 667
Antidote, Jeaunel's general, 974
universal, 974
Antiemetics, 43
Antifebrin, 904, 933
Antihydrotics, anhydrotics, 45
Antilithics, 44
Antilope Dorcas, 662
Antimony, Antimonium (stibium), and potassium tartrate, oxide, sulphide (purified), sulphurated, 835, 837, 838
Antimonyl potassium tartrate, 836
Antipyrine, iodide, salicylate, 908, 947, 948
Antisepsin, 933
Antiseptics, 39
Antiseptin, 930
Antispasmodics, 40
Antitetanic globulins, 668
Antitoxinum tetanicum, 668
crudum, 669
Antizymotics, 39
Aperients, 43
Aphis s(ch)inensis, 160
Aphrodisiacs, 45
Apii fructus, 440
Apiol, 441
Apis mellifera, 640
Apium graveolens, 440
Apoatropine, 537
Apocodeine, 239
Apocynaceæ, 54, 491
Apocynum androsæmifolium, cannabinum, 495, 497
Apomorphine chloride, hydrochloride, 241
Aposterpine 537
Appendix, 973
Apple, 281
Carthaginian, 421
dead, sea, mad, oak, sodom, 155, 548
devil's, 548
garnet, 421
Grenadier, 421
of Peru, 548
punic, 421
Aqua, Aquæ Aromaticæ, 19
creosoti, 891
Laurocerasi, 275
melissæ, 517
phagedænica flava, 823
nigra, 828
phenolata, 888
Arabin, 284
Arachis hypogæa, 319, 560
Aralia Ginseng, nudicaulis, quinquefolia, racemosa, spinosa, 435, 436, 437
Araroba, 323
Arbor Vitæ, 80
Arbutin, 465
Arctium Lappa, 387, 621
Aretium minus, 621
Arctostaphylos glauca, mucrocifera, polifolia, Uva-ursi, 463, 466
Areca, Catechu, 100, 287
nut, 100, 287
Argemone mexicana, 257
Argyrol, 817
Arisæma triphyllum, 101
Aristol, Aristolum, 894
Aristolochia, hastata, reticulata, Serpentaria, 175, 176
Aristolchiaceæ, 51, 174
Aristolochine, 176
Armoraciæ radix, 256
Arnica, alpina, Chamissonis, flowers, foliosa, montana, 619, 620
Arnotto family, 415
Aromatics, 43
Aromatol, 888
Arrow-root, 138
Brazilian, 91
Arsenic, Arsenicum, Arsenum, 831
antidote, 783
tri-iodide, 833
trioxide, 831
white, 831
Arsenous, iodide, 833
oxide, 831
Arsphenamine, 834, 926
Artemisia Abrotanum, Absinthium, abyssinica, gnaphalodes, Ludoviciana, maritima, pauciflora, ramosa, Sieberi, vulgaris, 609, 610, 611, 612
Arthriticine, 945
Artificial heavy spar, 767
Arum triphyllum, 101
Asa dulcis, 467
Asafetida, Asafœtida, amygdaloid, gum, liquid, lump, milk, stony, tears, 450, 452
Asafœtida præparata, 453
Asagræa officinalis, 105
Asaprol, 944
Asarum canadense, 176
Asclepias, Cornuti, curassavica, incarnata, syriaca, tuberosa, 498, 499, 590
Aselline, 645
Asepsin, 933
Aseptol, 927
Asparagin, 398
Aspidin, albaspidin, aspidimin, aspidinol, 69
Aspidium, athamanticum, rigidum, 67, 70
Aspidosperma quebracho-blanco, 497
Aspirin, aspirinum, 898, 940
Astacus fluviatilis, 635
Asthma weed, 606
Astragalus, bæticus, crotalariæ, glycyphyllos, gummifer, mollissimus, 311, 314
Astringents, 39
Atophan, 908
Atropa, Belladonna, mandragora, 533, 542

Atropamine, 536, 537
Atropine, atropina, 536
sulphate, 537
Atrosin, 538
Aubletia trifolia, 349
Aunyle, 443
Aurantiamarin, 354
Aurantii dulcis cortex, 356
Aurantiin, 354
Aurantium, 353
Aurum, 838
Avena sativa, 91, 95
Axungia Castoris, 662

B

Babla(c)h pods, 282
Baccæ spinæ cervinæ, 395
Bachelor's buttons, 479
Bacteria vaccines, 950
Balæna australis, mysticetus, 646
Balm, 517
of Gilead, 368
buds, 153
Balsam apple, 600
wild, 598
of copaiba, 287
of fir, 82
of Peru, 306
of tolu, 303
Oregon, 83
poplar buds, 153
Balsamito, 308
Balsamo blanco, 308
Balsamum Gileadense, 368
Perurianum, 306
tranquillans, 547
Balsemodendron Opobalsamum, 368
Banewort, 533
Bangue, 165
Baptisia tinctora, 309
Baptisin, 310
Barberry bark, 422
family, 210
Barbital, 882, 925
sodium, 883, 925
soluble, 883, 925
Barbitone, 882
sodium, 883
Barium, 767
carbonate, 768
chloride, 768
dioxide, 768
sulphate, roentgenographicus, 767
Bark, angustura, 352
false, 352
babul, 287
bayberry, 153
bebeeru, 232
Calisaya, 561
Carthagena, 577
copalchi, 376, 498
copper-colored, 578
coto, 233
Bark, cotton root, 404
cramp, 592
cuprea, 578
cusco, 577
cusparia, 352
dogwood, 456
elm, slippery elm, 164
false angustura, 484
Loxa, 577
fringe tree, 475
gray, 577
hard yellow, 577
Honduras, 364
Huamalies, 577
Huanuço, 577
Jean, 577
Lima, 577
Malambo, 376
Mancona, 292
Maracibo, 577
Margosa, 369
oak, tanners, white, 160
olive, 476
ordeal, 292
Paracoto, 233
Persian, Persiana, Purchiana, 391
pine, white, 80
pitaya, 577
pomegranate, 421
Quebracho, 497
red, Peruvian, 561
sacred, 391
Saint Ann's, 561
sassy, 292
Savanna, 163
soap, 268
tree, 268
wahoo, 388
wax myrtle, 153
white ash, 475
wild black cherry, 272
yellow, Peruvian, 561
Barosma, betulina, crenulata, Ecklon-iana, pulchella, serratifolia, 341, 342, 343
Barosmin, 343
Barren myrtle, 463
Barytes sulphate, 767
Basham's mixture, 778
Bassorin, 314
Bastard teak, 320
Baume tranquille, 547
Bay, 430
rum, 431
Bdellium, African, Indian, 368
Beal fruit, 362
Bear wood, 391
Bearberry, red, 391, 463
Bear's foot, 200
grape, 463
weed, 507
Beaver, 661
Beech, American, 163
family, 155
Beef extract, 664

Beef tallow, 656
Beggar-lice, 622
Behemic acid, 253
Belæ, fructus, 362
Belladonna, Japanese, 542
leaves, root, 533
Belladonnine, 536, 537
Bell-flower family, 605
Bengal quince, 362
Benjamin tree, 467
Benzaconine, 205
Benzaldehyde, Benzaldehydum, 278
Benzanalgene, 946
Benzanilid, 936
Benzene, benzenum, benzol, 886
derivatives containing nitrogen 903, 932
Benzocaine, 885
Benzoic acid, 305
-benzyl ester, 308
Benzoin Benzoin, 233
benzoinum, belly, Catappa, false, foot, head, inferior, laurel, medium, Palembang, Penang, Siam, Sumatra, superior, 467, 468, 469
Benzoinated lard, 471, 650
Benzonaphthol, 943
Benzo-para-cresol, 928
Benzophenol, 886
Benzosol, 930
Benzosulphinide, Benzosulphinidum, 906, 939
Benzoylacetyl peroxide, 922
Benzoyl-anilid, 936
Benzoyl-naphthol, 943
Benzoyl-pseudotropeine hydrochloride, 949
Benzoyl-pseudotropeine hydrochloride, 949
Berberidaceæ, 51, 210
Berberine, 197, 217
Berberis, Aquifolium, canadensis, vulgaris, 214, 215, 422
Bergamia, Bergamot, 361
Berries, saw palmetto, 98
Beta-colchicoresin, 109, 110
Betaeucaine hydrochloride, 910
lactate, 911
Betaine, 398
Beta-iso-amylene, 916
Beta-mono-hydrox-naphthalene, 901
Betanaphthol, 901, 943
Beta-naphtholum benzoicum, 943
Betel nut, 287
Beth (birth) root, 121
Betol, 940
Betula, alba, lenta, papyrifera, 155, 460
Betulin, 460
Bhang, bang, 168
Bidens bipinnata, 622
Bija, 320
Bilberry, 463
Bilis bubula, 663
Birch, black, canoe, cherry, mahogany, paper, spice, sweet, white, 155, 460
Bird's-foot, 415
Birthwort, thick, 175
family, 174
Bismuth, bismuthum, 810
and ammonium citrate, 814
betanaphthol, 813
carbonate, basic, 812
citrate, 814
gallate, basic, 813
nitrate, basic, 811
oxide, 815
oxycarbonate, 812
oxygallate, 813
oxyiodogallate, 930
oxysalicylate, 812
salicylate, basic, 812
subcarbonate, 812
subgallate, 813
subnitrate, 811
subsalicylate, 812
tribromophen-ate-ol, 930
white, 811
Bismuthi magma, 811
Bissabul, 367
Bistort, 184
Bitter almond, 275
apple, 601
ash, bark, quassia, wood, 362
stomach drops, 490
Bittersweet, 540
Bitter-wood tree, 362
Bitterwort, 488
Bitumen, sulphonated, 846
Bixaceæ, 415
Black alder, 391
balsam, 306
cohosh, 200
draught, 297
drop, 246
haw, 591
lotion, 828
snakeroot, 200
walnut, 154
wash, 828
Blackberry bark, 267
Black-eyed Susan, 622
Bladderwrack, 58
Blatta orientalis, 639
Bleached, white, beeswax, 642
Blennorrhetics, 44
Blister beetle, 636
Blisters, 46
Blood, 673
root, 249
Blooming spurge, 383
Blue cohosh, 214
flag, 127
gum-tree (leaves), 431
mass, 820
ointment, 820
pill, pills, 820
vervain, 508
violet, 415
Blue-rocket, 204
Blue-stone, vitriol, 808

Blumea balsamifera, 232
β-methyl æsculetin, 538
Bœhmeria nivea, 401
Bogbean, 491
Boldine, 222
Boldo leaves, 221
Boldu, boldus, 221
Boletus fomentarius, 66
Boluses, 23
Bone, 673, 685
Bone-black, 685
Boneset, 615
rough, 616
Bookoo, Bucco, Bucku, Buku, 341
Borax, 724
Boron, 688
Boro-thymol zinc iodide, 930
Bos taurus, 663
Boswellia Carterii, 368
Bougies, pencils, 24
Box, 464
Boxwood bark, 422
Brake, knotty, sweet, 67
Brandy, 850
Brassic acid, 253
Brassica, arvensis, campestris, juncea, Napus, nigra, oleracea, Rapa, Rutabaga, Sinapistrum, 252, 256
Brauneria augustifolia, pallida, 617
Brayera, 268
Brayerin, 270
Breïn, 368
Bremen green, 809
Brimstone, 690
Bromdiethylacetyl carbamide, 703
Bromdiethylacetylurea, 703
Brom-ethylene, 919
Bromine, bromum, 701
Bromol, 926
Bromoform, 862, 917
Bromphenolis, 930
Broom corn, 96
tops, 309
mustard, 252
Brownian movement, 414
Brucine, brucina, 480, 482
Brunella vulgaris, 511
Brunfelsia Hopeana, 551
Bryonia, africana, alba, americana, dioica, epigæa, Kedrostis nana, 599, 600
Bryonin, 600
Bryony, 599
Buceras angustifolius, 469
Buchu, 341
Buckbean, 491
Buckthorn bark, 394
berries, 395
family, 391
Buckwheat family, 177
Bugbane, 103, 200
Bugle weed, 517
Bugwort, 103, 200
Buja, 321
Bunch-flower family, 102
Burdock root, 621
Burned lime, 757
Burnett's disinfecting fluid, 797
Burseraceæ, 52, 365
Bush, Benjamin, spice, 233
Bush-tree dudgeon, 464
Butea frondosa, gummi, 321
Butter, butyrum, 672
of zinc, 796
Buttercup, bulbous, 209
Buttermilk, 672
Butternut bark, 154
Butyl-chloral hydrate, 921
Buxus sempervirens, 422, 464

C

Cabbage, 256
Cacao, 404, 407
butter, 404
prepared, 407
Cachets, 24
Cactus grandiflorus, 419
Cadlock, 252
Cadmium, 803
Cæsalpiniaceæ, 287
Caffea, coffee, 580
Caffeine, caffeina, 409, 580, 948
citrated, 582
effervescent, 583
sodio-benzoate, 582
sodio-salicylate, 583
Cajuput, Cajuputum, 428
Cajuputol, 429, 433
Calabar bean, 326
Calabarine, 328
Calamina præparata, 801
Calamus Draco, root, 100, 101
Calceolaria Ipecacuanha, 590
Calcis, carbonas durus, 766
mollis (soft), 766
Calcium, 756
beta-naphthol-alpha-mono-sulphonate, 944
bromide, 763
carbonate, precipitated, 760
chloride, 760
glycerophosphate, 761
hypochlorite, 758
hypophosphite, 764
iodobehenate, 764
lactate, 763
lactophosphate, 765
moniodobehenate, 764
oxide, 757
phosphate, precipitated, 765
sulphate, dried, 766
sulphide, crude, 766
Calculi cancrorum, 635
Calendula, officinalis, 621
Calico-bush, 466
Calioben, 764
Callitris quadrivalvis, 83
Calomel, 827

Caltha palustris, 103
Calumba, columba, columbo, 215
Calumbin, 217
Calx, 757
Camillia japonica, oleifera, 411
Campanulaceæ, 54, 66, 605
Camphor, Camphora, artificial, Barus, Borneo, Borneol, China, Dutch, Formosa, Japan, laurel, monobromated, Ngai, Sumatra, tub, 227, 228, 229, 232
coal-tar, 902
Camphora monobromata, 231
Canada fleabane, 623
Canadian moonseed, 221
Canadine, 197
Canarium commune, 368
Canella, Canellæ, alba, cortex, Winterana, 414
Canna edulis, 139
Cannabinol, Cannabin, 167
Cannabis, Americana, indica, sativa, semen, 165, 166, 169
Cantharides, 636
Cantharidin, cantharidinum, 637
Cantharis, atrata, cinerea, marginata, Nuttalli, vesicatoria, vittata, 636, 639
Caoutchouc, 383
Capsaicin, capsacutin, capsicin, capsicine, 531, 532
Capsicum, annuum, cerasiforme, fastigiatum, frutescens, longum, 530, 533
Capsicums, 533
Capsules, capsulæ, 24
Caramel, 98
Caraway, American, Dutch, English, fruit, German, Holland, Mogador, seed, 441, 442
Carbamidated quinine dihydrochloride, 571, 572
Carbasi, 25
Carbon, 684
compounds, organic, 841
non-pharmacopœial, 913
disulphide, 685
perchloride, 686
tetrachloride, 686
Carboxyl derivatives, 939
Carbromal, carbromalum, 703
Cardamom, Alleppi, bastard, Ceylon, Ceylon-mangalores, Ceylon-mysore, Java winged, Madras, Malabar, Mangalore, Mysore, round, Siam, wild, 134, 136, 137, 138
seed, 134
Cardiac depressants, sedatives, stimulants, tonics, 42
Cardinal-flower, 608
Carex arenaria, 126
Carica Papaya, 418
Caricin, 418
Carlina acaulis, thistle, 617
Carminatives, 43
Carmine, Carminum, 633
Carolina buckthorn, 396
Carolina pink, 487
Carrageen, 58
Carrot family, 437
seed, 456
Carthamus tinctorius, 627
Carum, Carui, Carvi, 441
Carvies, 441
Caryophylli aromatica, 425
Caryophyllin, 427
Caryophyllus aromaticus, 424
Cascara Amarga, 364
sagrada, 391
Cascaria, 348
Cascarilla, 376, 578
Cassia, acutifolia, æthiopica, angustifolia, Annam, brevipes, elongata, Fistula, holosericea, lanceolata, lenitiva, marylandica, medica, obovata, officinalis, orientalis, ovata, pubescens, purging, Senna, 292, 294, 295, 298, 299
buds, 227
Cassiæ flores, 227
Castanea, dentata, pumila, 163
Castor bean, 378
fiber, 661
oil plant, 378
Castoreum, 661
Cataplasm emollient, 399
Cataplasm-a, cataplasm-ata, cataplasms, 22
kaolini, 774
Cataria, 511
Catechol-monomethylether, 893
Catechu, nigrum, 286
Cathartics, 43
Catnep, catmint, 511
Caulophyllum, thalictroides, 214
Caustic potash, 707
soda, 728
Caustics, 46
Cedar, berry-bearing, prickly, red, shrubby red, Spanish, 85, 86, 87
Cedrarine, 946
Celandine, 250
Celery fruit (seed), 440
Cellulose, 313
Centaury, Centaurium, American, European, 490, 491
Cephaëline, 586, 587
Cephaëlis acuminata, Ipecacuanha, tomentosa, 584, 585, 586
Cera alba, flava, 640, 641, 642
Cerasus, serotina, virginiana, 273
Cerate, 651
blistering, 637
cantharides, 637
Goulard's, 806
rosin, compound, 77
simple, 651
Turner's, 801
Ceratin, 666
Cerat-um, -a, cerates, 19
cantharidis, 77, 637
cetacei, 649

Ceratum, resinæ compositum, 77
Cerebral depressants, 40
excitants, 40
Cerevisiæ fermentum compressum, 64
Cerium, 774
oxalate, 774
wire, 776
Ceruleinum, 726
Cervus Elaphus, 662
Cetacea, 648
Cetaceous order (family), 648
Cetaceum, 648
Cetraria islandica, 65
Cevadilla, 105
Cevadine, cevine, 103, 106
Chalk, Creta, 766
drop, 762
French, 687
precipitated, 760
prepared, 762
Chamæcyparis sphæroidea, 80
Chamælirium luteum, 107
Chamomile, German, Roman, 618, 624
Chandam, 319
Charas, churras, churrus, 165, 168
Charcoal, animal, vegetable, 684, 685
Charlock, jointed, 256
Chart-a, chart-æ, papers, 22
sinapis, 254
potassii nitratis, 718
Chaulmoogric acid, 416
Checker berry, 460
Cheese, 672
Cheesebowl, 236
Chelerythrine, 251
Chelidonic, chelidoninic, acid, 251
Chelidonine, 251
Chelidonium, majus, 250
Chemical food, 766
Chenopodiaceæ, 51, 185
Chenopodium, album, ambrosioides, anthelminticum, Bonus Henricus, Botrys Vulvaria, 185, 187
Chermes, 634
Cherry, blackchoke, cabinet, choke, laurel, whisky, wild, 272, 273, 275
Chestnut leaves, 163
Chia-seed, 516
Chicory, 613
Chillies, African, 530, 533
Chimaphila, maculata, umbellata, 463, 464
Chinaphenine, 935
Chinese blistering flies, 639
Chininum, 567
Chinoidin, chinoidinum, 574
Chinovin, 574
Chinquapin, 163
Chionanthus virginica, 475
Chirata, 490
Chittem bark, 391
Chloral camphoratum, 858
hydrate, 857, 921
(monochloral) antipyrine, 948
urethane, 924
Chloralamide, 921
Chloralformamide, 921
Chloralose, 922
Chloramine, chloramina, 698
Chloramine-T, 698
Chlorbutanol, 863
Chlorcosane, 847
Chloretone, 863
Chlorine, 698
Chlorodyne, 246
Chloroform, 860, 917
Chlorpyrine, 948
Chocolate, 407
tree, 404
Cholagogue purgatives, 44
Chondrin, 646
Chondrodendron tomentosum, 219
Chondrus crispus, 55, 58
Chop nut, 326
Choripetalæ, 144
Chromium, trioxide, 794
Chrysanthemum, carneum, cinerariæfolium, Leucanthemum, roseum, segetum, 627
Chrysarobin, chrysarobinum, 323, 324
crude, 323
Chrysophan, 296
Chundana, 319
Cibus Deorum, 450
Cichorium, Endivia, Intybus, 613
Cigarettes, 24
Ciliary excitants, 42
Cimicifuga, racemosa, 200
Cimicifugin, 202
Cinchona, australis, barbacœncis, Bonplanda, Calisaya, Cascarilleros, Colombian, Condaminea, coppicing, cordifolia, crispa, crown, glandulifera, gray, Humboldtiana, lancifolia, Ledgeriana, Loxa, micrantha, mossing, nitida, officinalis, pale, peruviana, pitayensis, pubescens, purpurea, scraping, shaving, succirubra, tucujensis, yellow, 561, 563, 565, 566, 574, 577
Cinchona-red, 563, 574
Cinchonidine, cinchonidina, 573
sulphate, 573
Cinchonine, cinchonina, 573
sulphate, 573
Cinchonism, 576
Cinchophen, 908
Cineol, 433
Cinnabar, 829
Cinnaldehydum, 227
Cinnamein, 308
Cinnamene, 259
Cinnamic aldehyde, 227
Cinnamomum, aromaticum, Burmanni, Camphora, Cassia, iners, Loureirii, Saigonicum, Tamala, 222, 224, 227
Cinnamon, Annam, Ceylon, Chinese, God's Saigon, white, 222, 224, 227, 414
wood, 233
Cinnamyl cinnamate, 259

Cinnamyl-truxil-isotropyl-cocaine, 337
Cinquefoil, 271
Cissampelos pareira, 221
Citron, 361
Citrullin, 603
Citrullus Citrullus, Colocynthis, vulgaris, 601, 605
Citrus, amara, Aurantium, Bergamia, Gæta, imperial, Limonum, medica (acida), sinensis, wax, 353, 354, 356, 358, 359, 361
Civet, Civetta, 662
Clarified honey, 640
Claviceps purpurea, 60
Closed-chain compounds, 926
Clotbur, 621
Clove, Cloves, Amboyna , Bencoolen, Molucca, S. American, Sumatra, wild, 425, 426, 430
Clover blossoms, red, yellow sweet, 310
Clysters, 25
Coca, Cuca, Cuzco, folia, Huanuco, leaves, Trujillo, Truxillo, 334, 336, 337
family, 334
Cocaine, cocaina, 337, 948
chloride, 337
hydrochloride, 337, 948
Cocainism, habit, 339
Cocales, 335
Cocanine, 337
Coccerin, 633
Coccoloba uvifera, 322
Cocculus, indicus, palmatus, 217, 218
Coccus, cacti, ilicis, 631, 634
Cochineal insect, black-grain, silver-grain, 631, 632
Cochlearia Armoracia, 256
Cocillana, 368
Cocklebur, broad, 623
Cockroach, 639
Cocoanut oil, 101
Cocos nucifera, 101
Codeia, 242
Codeine, codeina, 239, 242
phosphate, 243
sulphate, 243
Coffea, arabica, liberica, mauritiana, tosta, zanguebaria, 409, 580, 581, 583, 584
Coffee, Brazilian, Ceylon, Demerara, E. Indian, Java, Liberian, Mocha, Rio, roasted, W. Indian, 581, 583
Cola, acuminata, nitida, 407, 584
nut, 584
Colchiceine, 109, 110
Colchicina, colchicine, 109, 110
Colchicoresin, 109, 110
Colchicum, autumnale, bulbus, corm, radix, seed, tuber, variegatum, 107, 108, 112
Cold, 18
cream, 265
seeds, 604
Coleoptera, 635
Coleopterous order (family), 635
Collinsonia canadensis, 527
Collodion, cotton, croton oil, flexible, iodine, iodoform 380, 402, 403
Collodi-um, -a, collodions, 19
bituminis sulphonati, 846
cantharidatum, 638
salicylicum compositum, 897
stypticum, 158
tiglii, 375
Colloxylin, 402
Collyri-um, collyri-a, 25
Colocynth, Colocynthis, apple (fruit), cucumber, gourd, Mogador, peeled, pulp, Turkey, unpeeled, 601
Colocynthin, Colocynthitin, 602, 603
Colombo, Columbo, Kalumb, American, 215, 491
Colt's foot (leaves), 619
Columbrina, 479
Colutea arborescens, 294
Colza, 256
Combretum sundaicum, 249
Commiphora, Africana, Mukul, Myrrha, Opobalsamum, 365, 366, 368
Common anise, 443
milkweed, 498
polypody, 70
speedwell, 559
Compositæ, 54, 608
Composite (Thistle) family, 608
Compressed yeast, 64
Condurango, 499
Confecti-o, confecti-ones, confections, 23
rosæ, 265
sennæ, 297
Conhydrine, 439
Coniferæ, 49, 72
Coniine, 439
Conium, maculatum, 438
Consumptive's weed, 507
Contrayerva, 172
Convallaria majalis, multiflorum, 120, 121
Convolvulaceæ, 54, 499
Convolvulin, 502
Convolvulus, Mechoacanna, panduratus, Scammonia, 504, 506
Conyza squarrosa, 554
Copaiba, balsam, confertiflora, cordifolia, coriacea, guianensis, Jacquini, Jussieui, Langsdorffii, Maracaibo, Maranham, Martii, multijuga, nitida, oblongifolia, officinalis, Para, Rio Janeiro, solidified, Surinam, 287, 288, 289, 290
Copal, 291
Copalm balsam, 258
Copper, cuprum, acetate, ammoniated, subacetate, sulphate, 808, 810
Copperas, 780
Coptis trifolia, 199
Coral, 635
Corallium, rubrum, 635
Cordial, cordiale, 21

Cordial, cascara sagrada, 394
neutralizing, 182
Coriander, Coriandrum, sativum, 437
seed, 437
Coriaria myrtifolia, 294
Corn, broom, 96
cure, 897
Guinea, 87
Indian, 87
silk, 89
smut, 67
Turkish, 87
Cornu Cervi, 662
Cornus Amomum, circinata, florida, sericea, 456, 457
Corrosive sublimate, 822
Corydalis, 251
Cosmoline, white, 843, 844, 845
Cotarnine chloride, 243
phthalate, 243
Cotton, 400
wool, 400
Cottons, medicated, 403
Cottonseed tea, 403
Cough-wort, 619
Coumarin, Coumarinum, 325
Coumarouna odorata, 325
Counter-irritants, 46
Countess' powder, 561
Cow, 663
Cowberry, 464
Cowhage, Cowitch, 325
Cow-parsnip, 455
Crabs' eyes, stones, 635
Cracca Apollinea, 294
Cranberry bark, 592
mountain, upland, wild, 463
Cranesbill, 330
Crawfish, 635
Cream of Tartar, 711
Creolin, creolinum, 892, 928
Creosote, 889
carbonate, 890
Cresol, cresolum, 891, 928
Crocus, autumn, fog, meadow, Michaelmas, purple, sativus, 107, 128
Croton, Eluteria, lucidus, Malambo, niveus, oblongifolius, pseudochina, Tiglium, 372, 374, 376, 498
oil plant, 372
seeds, 373
Croton-chloral hydrate, 921
Crow-fig, 479
Crowfoot family, 194
Crow-silk, 55
Cruciferæ, 251
Crystals of Tartar, 711
Cubeb, cubeba, false, 144, 147
Cubeba, canina, Lowong, Wallichii, 147
Cubebin, 146
Cubebs, tailed, 144
Cuckoo's cap, 204
Cucumber, squirting, wild, 597, 598, 601
Cucumis Citrullus, 605
myriocarpus, 600
Cucurbita, Citrullus, Pepo, 604, 605
Cucurbitaceæ, 54, 597
Cudbear, 65
Culver's root, 558
Cupressus thyoides, 80
Cupuliferæ, 50, 155
Curara, curare, 485
Curati-o, -ones, dressings, 23
paraffini, 847
Curcuma, longa, viridiflora, Zedoaria, 91, 134
Curd, 672
Cusparia Angostura, 352
Cusso, 268
Cuttle-fish bone, 635
Cyaponia americana, 600
Cydonia, Cydonia, 280
Cynanchum Vincetoxicum, 370, 595
Cynips tinctoria, 156
Cypripedin, 144
Cypripedium, bulbosum, hirsutum, parviflorum, pubescens, 143, 144, 175
Cystogen, 856
Cytisus Scoparius, Scoparius, 309

D

Dæmonorops Draco, 100
Dalby's carminative, 754
Dalmatian insect powder, 627
Damiana, 417
Dammar, Dammara, 83
Dandelion, 612
Daphne, Gnidium, Laureola, Mezereum, salicifolia, 419, 420
Darkness, 18
Datura, alba, fastuosa, Metel, sanguinea, Stramonium, Tatula, 548, 551
Daturæ folia, semina, 551
Daturine, 549
Daucus Carota, 456
Dead men's bells, 553
Death's herb, 533
Decoction, aloes, compound, 115
althea, 399
chenopodium, 186
cimicifuga, 202
cinchona, 575
colt's foot, 619
frangula, 395
gossypium, 404
hæmatoxylon, 303
hydrastis, 198
inula, 617
ipecac, 588
linseed, 333
night-blooming cereus, 419
pareira, 221
phytolacca, 188
pomegranate, 424
rhus glabra, 385
scoparius, 309
scutellaria, 511
senecio, 621
strophanthus, 495

Decoction, taraxacum, 613
uva ursi, 465
viburnum prunifolium, 592
Decoct-um, -a, decoctions, 19
Dehydrodimethylphenylpyrazine, 908
Delphinine, 204
Delphinium, Ajacis, azureum, carolinianum, Consolida, exaltatum, Staphisagria, urceolatum, 203
Demerara pink root, 487
Demulcents, 46
Dendrium buxifolium, 464
Dental anodynes, 43
Dentifrici-um, -a, dentifrices, 23
Dentiliniment-um, -a, dental liniments, 23
aconiti compositum, 206
et iodi compositum, 206
Deodorants, 40
Depresso-motors, 41
Dermatol, 813
Des-oxy-alizarin, 325, 944
Devil's apple, 210
bite, 103
dung, 450
trumpet, 548
Dewees' carminative, 453, 754
Dextrin, dextrinum, album, white, 92
Dextrose, 91
Diacetylmorphine, Diamorphine, 242, 948
hydrochloride, 242, 949
Diaminodihydroxarseno-benzene hydrochloride, 834
Diamorphine, 948
hydrochloride, 949
Diaphoretics, 44
Diaphtherin, 945
Diastase, Taka-diastase, diastasum, 97
Diatomaceous earth, 687
Dicentra, canadensis, Cucullaria, 251
Dichloramine, dichloramina, 699
Dichloramine-T, 699
Di-chlor-ethane, 918
Di-chlor-methane, 917
Dichlormethyl chloride, 860
Dicotyledones, 144
Diethylbarbiturate, 883
Diethylene-diamine, 945
Diethylmalonylurea, 882, 925
Diethyl-sulphon-diethyl-methane, 923
Diethylsulphonedimethylmethane, 867
Diethylsulphonemethylethyl methane, 867
Digitalin, Digitalinum, French, German, 555
Digitalis, ambigua, ochroleuca, purpurea, 553, 554
Digitophyllin, 555
Digitoxin, 555
Digitsaponin, 555
Di-hydroxy phenol derivatives, 930
Dihydroxyphthalophenone, 899
Di-iodo-beta-naphthol, 944
Diiodomethyl-iodide, 864
Di-iodo-para-phenyl-sulphonic acid, 927
Di-iodo-thiophene, 926
Di-iso-butyl-ortho-cresol-iodide, 929
Dill fruit, 449
Dimethylamino-antipyrine, 909
Di-methyl-ethyl-carbinol, 920
Dimethyl-ketone, 866
Dimethyl-phenyl-isopyrazolone, 908
Dimethyl-piperazine tartrate, 945
Dimethylxanthine, 407, 409, 948
Dionin, 241
Dioscorea, villosa, 126
Dioscorein, 126
Diosma, 341
Diosmin, 343
Diosphenol, 342
Diospyros virginiana, 467
Dioxy-anthrol, 944
Dioxythiphenylphthalide, 899
Diphtheria antitoxin, concentrated, purified, refined, 667
Dipterocarpus alatus, 291
Dipteryx odorata, 325
Discutients, 39
Disinfectants, 40
Disodium salt of hydroxymercuri-dibromfluorescein, 830
Dispensatories, 19
Dithymoldiiodide, 894
Diuretics, 44
Diuretin, 406, 948
Dock, curled, red-veined, water, yellow, 183, 184
Doft-berry, 533
Dogbane, 495
family, 492
Dog-buttons, 479
Dog-fennel, 616
Dog poison, buttons, 479
Dog's finger, 553
Dogwood, Jamaica, 230
round-leaved, 457
swamp, 320, 457
Donovan's solution, 825
Dorema Ammoniacum, Aucheri, robustum, 454, 455
Dorstenia Contrayerva, 172
Double tansy, 627
Dover's powder, 588
Draconis resina, 100
Dragée, 25
Dragon's blood, 100
Drastic purgatives, 43
Drimys Winteri (granatensis), 190
Drosera, anglica, longifolia, rotundifolia, 256
Drugs, organic, from animal kingdom, 631
Drupaceæ, 272
Dryobalanops, aromatica, camphora, 232
Dryopteris, athamantica, Filix-mas, marginalis, rigida, 67, 70
Duboisia myoporoides, 548
Duboisine, 548
Duckretter, 103

Duck's foot, 210
Dulcamara, 540
Dulcin, 925
Dulse, 59
Duotal, 893
Dutch liquid, 917
Dwale, 533
Dwarf elder, 591
Dway-berry, 533
Dysentery bark, 365

E

Earth gall, 103
Eau médicinale d'Husson, 111
Ecballium, Elaterium, 597
Ecbolics, 45
Echinacea, 617
Egg albumen, fresh, 647
yolk, fresh, 647
Egg-shell, 647
Egyptian thorn, 282
Elæis guineensis, 100, 328
Elastica, 383
Elaterin, Elaterinum, 597, 598
Elder flowers, 590
Elecampane, 616
Electricity, 18
Elemi, 368
Elettaria Cardamomum, major, 134, 138
Elixir, elixira, elixirs, 20
aletridis compositum, 117
alkaline, 197
anisi, 445
ammonii bromidi, 746
valeratis, 750
amygdalæ compositum, 277
antiasthmatic, 383
aromatic, 358
aurantii amari, 355
bromidorum quinque, 715
trium, 715
buchu compositum, 89, 343
et potassii acetatis, 343
juniperi et potassii acetatis, 84 343
calcii et sodii glycerophosphatum, 738
lactophosphatis, 764
carnis et ferri, 665, 784
cascaræ sagradæ, 394
compositum, 394
catariæ et fœniculi, 511
catharticum compositum, 395
cinchonæ alkaloidorum, 575
cocillana, 369
corydalis compositum, 251
digestive, compound, 653
eriodictyi aromaticum, 508
euphorbiæ compositum, 383
ferri pyrophosphatis, quininæ et strychninæ, 787
quininæ et strychninæ, 779
chlorides, 823
Elixir, gentianæ, 489
et ferri, 489
phosphatis, 489
glycerinatum, 489
glycerophosphatum compositum, 738
glycyrrhiza, 318
guaranæ, 390
et apii, 390
heloniadis compositum, 107
hydrangeæ et lithii, 261
hydrastis compositum, 197
kola, 408
licorice, 318
manacæ compositum, 551
paregoric, 246
pepsini, 653
et bismuthi, 653
et strychninæ, 653
et rennin compositum, 653
phosphori, 695
et nucis vomicæ, 695
potassii bromidi, 715
sabal et santali compositum, 99
simple, 358
sodii bromidi, 731
salicylatis, 732
compositum, 732
taraxaci compositum, 613
terpini hydratis, 76
et codeinæ, 76
et creosoti compositum, 76
viburni opuli compositum, 593
prunifolii, 592
vitrol, 693
Elm, American, black, Indian, moose, red, rock, sweet, white, 164, 165
family, 163
Emetic herb (weed), 606
Emetics, 43
Emetine, emetoidine, 586, 587
hydrochloride, 587
Emmenagogues, 45
Emodin, 293, 296, 393
aloe-emodin, 114, 115
Emollients, 46
Emplastr-um, -a (plasters), 20
hydrargyri, 821
nitratis, 821
dilutum, 821
picis canadensis, 83
saponis, 477
Empleurum serrulatum, 341, 345
Emulsin, 274, 276
Emulsion, almond, sweet, 280
asafetida, 452
cod-liver oil, 645
oil of turpentine, 76
pepo, 605
Emuls-um, -a, emulsions, 20
chloroformi, 861
olei morrhuæ cum hypophosphitibus 645
malto, 645
vitello, 645

Emulsum olei ricini, 380
petrolati, 845
Endive, 613
Enemas, enemata, 25
English walnut, 154
Entada scandens, 327
Enzymes, digitalis, 555
of ergot, 62
Epigæa repens, 464
Epinephrine, epinephrina, 657
Epipremnum mirabile, 102
Epirenan, 657
Epispastics, 46
Epsom salt, 752
Equus caballus, 667, 668
Erechthites hieracifolia, 387, 623
Ergone, 64
Ergot, ergota, aseptic, German, Russian, Spanish, 60, 62, 64
Ergotine, ergotin, 63
Ergotoxine, ergamine, ergotinine, 62
Ericaceæ, 53, 460
Ericolin, Ericinol, 464, 465
Erigeron, annuus, canadensis, heterophyllus, philadelphicus, 623
Eriodictyon, californicum, tomentosum, 506, 508
Erodium, cicutarium, moschatum, 330
Errhines, 42
Ertela trifolia, 349
Eryngium, aquaticum, yuccæfolium, 440
Erythræa Centaurium, 490, 491
Erythronium americanum, 117
Erythrophlœine, 292
Erythrophlœum guineense, 292
Erythroxylaceæ, 52, 334
Erythroxylon bolivianum, Coca, truxillense, 334, 336, 337
Escharotics, 46
Eserine, Eseridine, 328, 329
Essence de Bigrade, 354
de Petale, 354
de petit grain, 354
de Portugal, 354
orange, 357
peppermint, 526
spearmint, 523
Essences, essentiæ, 21
Ethanol, dehydrated, diluted, 849
Ethene chloride, 917
Ether, 877
amylonitrous, 881
bromatus, 918
hydrochloric, 865
Ethers, 877, 923
Ethocaine, 884, 949
Ethyl acetate, 879
aminobenzoate, 885
bromide, 918
carbamate, 883, 924
chaulmoograte, 416
chloride, 865, 917
ether, 923
nitrite, 880, 924
oxide, 877, 923
Ethyl paramidobenzoate, 885
phenacetin, 906
Ethylated chloral urethane, 925
Ethylen hydrate, 877
Ethylene bi(di)chloride, 917
bromide, 919
Ethylene-imine, 945
Ethylidene chloride, 918
Ethylmethyl-pyrocatechol, 427
Ethylmorphine chloride, 241
hydrochloride, 241
Eucaine, 948
chloride, 910
hydrochloride, 910, 948
Eucalyptol, 433
Eucalyptus, amygdalina, dumosa, globulus, goniocalyx, gummi (gum), kino, Leucoxylon, obliqua, oleosa, resinifera, rostrata, Sideroxylon, viminalis, 322, 435, 475
Euchinin, 949
Eugenia Jambolana, 428
Eugenol, Eugenin, 426, 427, 931
acetamide, 931
Euonymin, 389
Euonymus, americanus, atropurpureus, europæus, 388, 389
Eupatorium, capillifolium, fœniculaceum, perfoliatum, purpureum, teucrifolium, verbenæfolium, 615, 616
Euphorbia, corrollata, hirta, Ipecacuanha, pilulifera, 382
Euphorbiaceæ, 52, 372
plantæ, 91
Euphorin, 924
Euquinine, 569, 949
European ash, 475
manna tree, 472
Europhen, 929
Exalgine, 934
Excito-motors, 41
Exogonium Jalapa, 499, 501
Exostemma, 578
Expectorants, 42
Extract, aconite, 206
aloes, 115
aspidium, 69
beef, 664
belladonna, 538
root, 539
calumba, 218
cannabis, 167
capsicum, 533
cascara sagrada, 393
powdered, 393
caulophyllum, 214
cinchona, 575
colchicum, 110
colocynth, 603
compound, 603
powdered, 603
powdered, 603
cubeb, 146
digitalis, 556
eriodictyon, 508

Extract, eucalyptus, 434
frangula, 395
glycyrrhiza, 317
pure, 317
Goulard's, 805
grindelia, 615
henbane, 546
hyoscyamus, 546
jalap, 503
licorice, 317
root, pure, 317
lobelia, 608
malt (malti), 97
nux vomica, 482
powdered, 482
oxgall, 663
powdered, 663
physostigma, 329
pilocarpus, 351
pituitary, 671
podophyllum, 213
pulsatilla, 208
quassia, 364
rhamnus purshiana, 393
rhubarb, 181
squill, acetic, 120
stramonium, 550
strophanthus, 495
valerian, 597
veratrum viride, 105
witch hazel, distilled, 260
Extract-um, -a, extracts, 20
belladonnæ viride, 539
conii, 440
ergotæ aquosum, 63
euonymi, 389
ferri pomatum, 776
gentianæ, 489
hæmatoxyli, 303
hydrastis, 197
hyoscyami viride, 547
Ignatiæ, powdered, 485
krameriæ, 301
lappæ, 622
leptandræ, 559
opii, 246
liquidum, 246
sumbul, 454
taraxaci, 613
thyroidei, 659
uvæ ursi, 465
Eye balm, 194
Eyebright, 606
Eye-washes, 25

F

Fabiana imbricata, 552
Face-in-hood, 204
Fagaceæ, 50, 155
Fagus, americana, ferruginea, pumila, sylvatica, 163, 401
Fairy cap, fingers, gloves, 553
False angustura, 479
unicorn, 107
Farfara, 619
Farina avenæ, 96
Fel bovinum, 663
bovis, purificatum, 663, 664
tauri, 663
Felwort, 488
Fennel, bitter, fruit (longs, shorts), giant, large, seed, sweet, wild, 446, 448
Fenugreek, 311
Fern, male, male shield, 67
family, 67
oil of, 69
Ferri oxidum saccharatum, 778
Ferric chloride, 777
citrate, 789
soluble, 784
ferrocyanide, 790
glycerophosphate, 785
hydrate with magnesia, 783
hydroxide, 789
with magnesium oxide, 783
hypophosphite, 786
oxide, saccharated, 787
phosphate, soluble, 784
with sodium citrate, 784
pyrophosphate, soluble, 786
valerate, 789
Ferrous, bromide, 788
carbonate, saccharated, 782
iodide, saccharated, 788
lactate, 786
oxalate, 788
sulphate, 780
dried, 780
exsiccated, 780
granulated, 781
precipitated, 781
sulphide, 788
Ferula, Asafœtida, fœtida, galbaniflua, Narthex, Sumbul, tingitana, 450, 453, 454, 455
Fever root (wort), 593
tree of Australia, 437
Ficus, Carica, 170
Field sorrel, 184
Fig, 170
Figwort family, 552
Filicin (filicic anhydride), 69
Filicinæ, 49, 67
Filix red, 69
Filmaron, 69
Finger flower, 553
Fire-weed, 548, 623
Flacourtiaceæ, 53, 415
Flax family, 330
liber-fibers, 334
Flaxseed, 331
cake, 334
Fleabane, Philadelphia, various-leaved, 623
Fleawort, 617
Flemingia rhodocarpa, 326
Flesh colored asclepias, 498
Flesh-consuming family, 49, 60
Flores malvæ arboreæ, 399

Flower, pelican, 175
Flowering ash, 472
fern, 70
spurge, 383
Flowers, arsenic, 831
of benzoin, 469
of lead, 804
of sulphur, 690
Fluidextract, anise, 445
anthemis, 625
aspidium, 69
belladonna leaves, root, 539
bitter orange peel, 353
buchu, 343
calisaya bark, 574
cannabis, 167
capsicum, 533
caraway, 443
cascara sagrada, 393
aromatic, 393
chenopodium, 186
cimicifuga, 202
cinchona, 574, 575
cinnamon, 226
coca, 338
colchicum, 111
colocynth, 603
conium, 440
coriander, 438
ergot, 63
eriodictyon, 508
eucalyptus, 434
fennel, 448
ginger, 132
glycyrrhiza, 317
henbane, 547
hydrastis, 197
hyoscyamus, 547
ipecac, 588
lactucarium, 614
licorice, 317
myrrh, 367
nutgall, 158
pepo, 605
pepper, 148
peppermint, 527
pilocarpus, 351
podophyllum, 213
pomegranate, 424
pyrethrum, 626
rhamnus purshiana, aromatic, tasteless, 393
rhubarb, 182
aromatic, 183
rhus glabra, 385
rose, 265
sassafras, 235
senega, 371
spearmint, 523
squill, 119
tansy, 626
tea, 411
uva ursi, 465
veratrum viride, 105
yerba santa, 508
Fluidextracta acetica, 24
Fluidextract-um, -a, fluidextracts, 20
aconiti, 206
adonidis, 199
aletridis, 117
angelicæ radicis, 449
apii fructus, 440
apocyni, 497
araliæ, 435
arnicæ, 620
asclepiadis, 498
avenæ sativæ, 96
baptisiæ, 310
boldi, 222
buchu compositum, 343
calendulæ, 621
calumbæ, 217
castaneæ, 163
cataríæ, 511
caulophylli, 214
chimaphilæ, 463
chionanthi, 475
chiratæ, 491
cocillanæ, 369
coffeæ, 583
colchici cormi, 110
condurango, 499
convallariæ radicis, 121
coptis, 199
corni, 457
corydalis, 251
cubebæ, 146
cypripedii, 144
damianæ, 418
digitalis, 556
dioscoreæ, 127
droseræ, 257
dulcamaræ, 541
echinaceæ, 618
euonymi, 389
eupatorii, 616
euphorbiæ, 382
ferri pomatum, 281
frangulæ, 395
fuci, 59
galegæ, 311
gelsemii, 486
gentianæ, 489
geranii, 330
gossypii corticis, 404
grindeliæ, 615
guaranæ, 390
hamamelidis foliorum, 260
heloniadis, 107
humuli, 169
hydrangeæ, 261
iridis, 127
jalapæ, 503
juglandis, 154
juniperi, 84
kavæ, 149
kolæ, 408
krameriæ, 301
lappæ, 622
leptandræ, 559

Fluidextractum, lobeliæ, 607
lupulini, 170
manacæ, 551
matico, 148
mezerei, 420
mitchellæ, 590
nucis vomicæ, 483
pareiræ, 221
phytolaccæ, 188
pruni virginianæ, 274
quassiæ, 364
rhamni catharticæ, 396
rubi, 267
rumicis, 184
sabal, 99
sanguinariæ, 250
santali albi, 174
scoparii, 309
scutellariæ, 510
senecionis, 621
serpentariæ, 176
solani, 541
stillingiæ, 382
compositum, 382
stramonii, 550
taraxaci, 613
thujæ, 80
thymi, 520
trifolii, 310
compositum, 310
trillii, 121
tritici, 98
valerianæ, 596
verbasci foliorum, 560
viburni Opuli, 593
prunifolii, 592
xanthoxyli, 345
zeæ, 89
Fluidglycerat-um, -a, fluidglycerates, 23
cascaræ sagradæ aromaticum, 394
glycyrrhizæ, 318
krameriæ, 301
rhei, 183
Fly blister, 637
Fungus (Agaric), 66
Fœniculum, dulce, French, German, Indian, Japanese, panmorium, Roman, Roumanian, Russian, sativum, Saxon, sweet, vulgare, 446, 447, 448
Folks' glove, 553
Fomentations, fomenta, 25
Food of the Gods, 450
Fool's parsley, 441
Forbidden fruit, 356
Formal, Formalin, Formol, 855, 923
Formaldehydum cresolatum, 855, 892
Formanilide, 932
Formica rufa, 642
Formin, 856
Fossil flour, 687
Fowler's solution, 833
Fox berry, 463
Foxglove, American, purple, 553
Foxtail, 70
Frangula, 394
Frankincense, common, 73, 80, 368
Frasera carolinensis, Walteri, 491
Fraxin, 474
Fraxinus, americana, excelsior, Ornus, 472, 475
Friar's balsam, 471
cap, cowl, 204
Frost-wort (weed), 414
Fructose, 94
Fructus Lappæ, Silybi, 622
Fruit (seed), Angelica, 448
Fucus, nodosus, palmatus, serratus, siliquosus, vesiculosus, 58, 59
Fuller's earth, 773
Fungi, 49, 60

G

Gadus æglefinus, callarias, carbonarius, merlucius, Morrhua, pollachius, 643, 644, 646
Gag root, 606
Galactagogues, 46
Galanga, Galangal, 132
Galbanum, 454
Galega, officinalis, 311
Galena, 803
Galipea Cusparia (officinalis), 352
Galla, 155
Gallacetophenone, 938
Gallanilide, 937
Gallanol, Gallinol, 937
Galls, Aleppo, American, European, Japanese, Mecca, Smyrna, Sorian, Syrian, Tamarisk, Turkey, 155, 156, 160
Gallus, Bankiva, domesticus, 647
Gambir, Gambier, 578
Gamboge, Cambogia, coarse, Cochin, fine, gum, lump, pipe, resin, roll, Saigon, 411, 413
family, 411
Gamopetalæ, 53, 460
Ganja, Gunjah, Guaza, flat, round, 165, 166
Garcinia Hanburyi, indica, Mangostana, Morella, pediculata, pictoria, purpurea, travancorica, 362, 411, 414
Garden rosemary, 509
Gargarism-a, gargarism-ata, gargles, 23
guaiaci compositum, 340
Garlic, 116
Gaultheria, procumbens, 460
Gaulterin, 460
Gauzes, 25
Gelatin, gelatinum, 665
Gelidiaceæ, 49, 55
Gelidium corneum, 55, 646
Gelose, gelosine, 55, 56, 57
Gelsemium, sempervirens, 485
Gentian, Catesbæi, Elliottii, pale, pannonica, punctata, purpurea, 488, 490
family, 487
Gentiana, asclepiadea, lutea, 488

Gentianaceæ, 53, 487
Gentianose, 489
Gentiin, gentienin, gentiogenin, 489
Gentiopicrin, 489
Genus, genera, 48
Georgia pink, 487
Geranin, 330
Geraniol (rhodinol), 266
Geranium, feather, maculatum, moschatum, Robertianum, 187, 330
German pellitory, 626
Germicides, 40
Geum rivale, 271
Gigartina acicularis, amansii, cartilagineum, mamillosa, pistillata, 55, 57, 58
Gillenia, stipulacea, trifoliata, 272
Ginger; African, black, Calcutta, Calicut, Chinese, coated, Cochin, E. Indian, green, hand, Jamaica, Japanese, peeled, preserved, race, scraped, uncoated, unpeeled, unscraped, white, wild, 129, 130, 131, 176
family, 129
Gingerol, 131
Ginseng, Chinese, 175, 436, 437
Gitalin, Gitin, 555
Glaucium Glaucium, corniculatum, luteum, 251
Glucose, glucosum, liquid, manna, syrupy, 91, 474
Glucosennin, 296
Glucusimide, 906
Gluside, glusidum, 906, 939
solubile, 939
soluble, 907
Glycerin, glycerol, glycerinum, 852
jelly, 666
phenol, 888
Glycerinated gelatin, 666
vaccine virus, 669
Glycerinum boracis, 724
plumbi subacetatis, 806
Glycerite, boroglycerin, 689
carbolic acid, 888
glyceryl borate, 689
phenol, 888
starch, 89
tannic acid, 158
Glycerit-um, -a, glycerites, 20
bismuthi, 811
pepsini, 653
picis pini, 79
tragacanthæ, 314
vitelli, 647
Glycerogelat-in-um, -a, glycerogelatins, 23
acidi salicylici, 897
iodoformi, 864
zinci durum, 799
molle, 799
Glycine hispida, 325, 561
Glycocoll-para-phenetidin hydrochloride, 936
Glycozone, 679
Glycyramarin, glycyrrhetin, 316, 317
Glycyrrhiza, Alicante, echinata, glabra, glandulifera, Italian, lepidota, peeled, Russian, Spanish, Tortosa, Turkish, typica, unpeeled, 314, 315, 316, 319
Glycyrrhizin, ammoniated, 316, 319
Gnaphalium, obtusifolium, polycephalum, 627
Goat's rue, European, 311
Gold (aurum), 838
and sodium chloride, 839
Golden apple, 356
seal, 194
Golden-rod, anise-scented, 623
sweet, 623
Goldthread, 199
Gonolobus Condurango, 499
Good King Henry, 187
Goosefoot, fetid, 185, 187
family, 185
Gossypii (Radicis) cortex, 404
Gossypium, album, arboreum, barbadense, herbaceum, nigrum, religiosum, stypticum, 400, 401, 403, 404
Gourd family, 597
towel, 600
Grahe's test, 578
Grain of Paradise, 138
Graminaceæ, 50, 87
Grana Molucca, sylvestra, tiglia, 373, 374, 633
Granatum, 421
Granilla, 633
Graniti fructus cortex, 422
Granular effervescent salts, 24
Granules, 25
Grape fruit, Oregon, 214
vine, 396
Grape-sugar, 91
Grass, couch, dog, 98
family, 87
Gravel plant, 464
root, 616
Great bilberry, 464
Greek nuts, 276, 279
Green vitriol, 780
Grindelia, camporum, cuneifolia, glutinosum, hirsutula, squarrosa, 614, 615
Ground laurel, 464
lemon, 210
raspberry, 194
Groundnut, 319, 560
Guaiac, 340
Guaiacol, guaiacolum, 892, 930
benzoate, 930
benzoyl, 930
carbonate, 893, 930
cinnamate, 931
cunnamyl, 931
salicylate, 931
salol, 931
Guaiacum, angustifolium, officinale, sanctum, 340
Guarana, 389, 580, 584

Guaranine, 389
Guarea Rusbyi, 368
Gum, Arabic, 282
Bassora, 313
Benjamin, 467
British, 92
camphor tree, 228
cashew, 313
cherry, 313
copal, 291
doctor's, 311
goat's thorn, 311
hog, hogg, 311, 313
Indian, 313
Kutera, 313
Senegal, 282
soluble, 314
tragacanth, 311
tree (wood), 431
Gum-bush, plant, 507
Gutta-percha, 466
Guttiferæ (Clusiaceæ), 53, 411
Guy's pills for dropsy, 556
Gymnospermæ, 49, 72

H

Hæmatoxylon, campechianum, 302
Hagenia abyssinica, 268
Halogen derivatives, 916
Halogens, haloids, 698
Halymenia, edulis, palmatus, 59
Hamamelidaceæ, 257
Hamamelidis folia, 260
Hamamelis, virginiana, 260
Hardhack, 272
Hardwickia pinnata, 290
Hart's horn, 662
Hasash, halish, haschisch, hasheesh, hashish, hasish, 165, 168
Hashabi, 283
Hayden's viburnum compound, 593
Hayo, 334
Heal-all, 511
Heat, 18
Heath family, 460
Hebbakhade, 367
Hedeoma, piperita, pulegioides, thymoides, 516, 517
Heerabul, 367
Helianthemum, canadense, 414
Hellebore, American, black, false, green, swamp, white, 103, 105, 199, 200
Helleborus, fœtidus, nigra, viridis, 199, 200
Helonias, 107
Hematics, 38
Helmin, 107
Hematoxylin, 302
Hemiptera, 631
Hemipterous order (family), 631
Hemlock, poison, small, 438, 441
Hemostatics, 46
Hemp, black Indian, Canadian, fibre, Indian, gallow grass, 165, 495
Henbane, black, 543
Henbell, 543
Hepar sulphuris, 709
Hepatica, Hepatica, triloba, 209
Herba botryos Mexicanæ, 187
Hercules' club, 435
Heracleum lanatum, 455
Heroin(e), 242, 948
hydrochloride, 949
Heron's-bill, 330
Hesperidin, 360
Heteropteris pauciflora, 585
Heuchera americana, 261
Hevea, brasiliensis, guianensis, 383
Hexamethylenamine, 856, 920
Hexamethylene-tetramine, 856
Hibiscus, 400
Hiera picra, 115, 414
High bush, 592
mallow leaves, 400
Hing, Hingra, 452
Hippo, 584
Hirudo, medicinalis, 634
Histamine, 62
Hive or honey bee, 640
Hoffmann's anodyne, 878
balsam, 308
drops, 878
Hog, 650
apple, 210
Hog-weed, 616
Hog's-bean, 543
Hollyhock, 399
Holocaine, 935
Homatropine bromide, 537
hydrobromide, homatropinæ hydrobromidum, 537
Homochelidonine, 251
Homopterocarpin, 320
Honey, 640, 641
rose, 265, 641
Honeys, 20
Hop, 169
Hop-tree, 352
Hordenine, 97
Hordeum, decorticum, vulgare, 96
Horehound, common, white, wild, 514, 616
Horn seed, 60
Horse-balm, 527
Horse-gentian, 593
Horse-mint, 516, 522
Horse-nettle, berries, 541
Horseweed, 623
Huile d'enfer, fermentée, vierge, 477
Humulus, lupulus, 169
Huxham's tincture of bark, 575
Hydnocarpus, anthelmintica, inebrians, Wightiana, 417
Hydracetin, 938
Hydragogue purgatives, 44
Hydrangea, arborescens, 260
Hydrarygyrum, 819
Hydrastin, 198
Hydrastine, hydrastina, 196

Hydrastine hydrochloride, 196
Hydrastinine hydrochloride, 197
Hydrastis, canadensis, 175, 194
Hydrated chloral, 857
Hydrobromic ether, 918
Hydrocarbons, 842, 916
Hydrogen, 677
  monoxide, 677
Hydrophobia antidote, 671
Hydrophyllaceæ, 54, 506
Hydroquinone, hydrochinone, 932
Hydrous chloral, 857
Hydroxylamine hydrochloride, 325
Hygrine, 337
Hymenoptera, 639
Hymenopterous order (family), 639
Hyoscine, 544, 545
Hyoscipicrin, 544, 546
Hyoscyami semen, 547
Hyoscyamine, 538, 544
  bromide, 544
  hydrobromide, 544
Hyoscyamus, agrestis, albus, aureus, muticus, niger, pallidus, 542, 544, 548
Hypnal, 948
Hypnone, 938
Hypnotics, 40
Hypocreaceæ, 49, 60
Hypophysis sicca, 670
Hyraceum, 662
Hyrax capensis, 662
Hyssop, 523
Hyssopus, officinalis, 523

I

Iaborandi, 349
Iceland moss, 65
Ichthyocolla, 646
Ichthyol, 846
Ichthyomethia Piscipula, 320
Igasurine, igasuria, 480, 482
Ignatia, amara, 484
Ilex, paraguensis, paraguayensis, verticillata, 391
Illicium, anisatum, floridanum, parviflorum, religiosum, verum, 189, 190, 443
Impatiens, aurea, biflora, 387
Imperatoria Ostruthium, 205
Indian, apple, 210
  dye, 194
  paint, 194
  physic, 272
  poke, 103
  salt, 384
  tobacco, 606
  tumeric, 194
  turnip, 101
Indigo carmine, 726
  false, wild, 309
Indigotin, 726
Inflatin, 607
Infusion, althea, 399
Infusion, anise, 445
  anthemis, 625
  arnica, 620
  belladonna, 539
  bitter orange, compound, 355
  bryonia, 600
  calumba, 218
  capsicum, 533
  caraway, 443
  cardamom, 138
  chionanthus, 475
  cinchona, 575
  cinnamon, 226
  clove, 428
  coca, 338
  coccus, 633
  colt's foot, 619
  coriander, 438
  cubeb, 146
  digitalis, 556
  eucalyptus, 434
  fennel, 448
  ginger, 132
  horehound, 514
  hyoscyamus, 547
  inula, 617
  ipecac, 588
  krameria, 301
  linseed, compound, 333
  lobelia, 608
  matico, 148
  matricaria, 619
  mustard, 255
  nutgall, 158
  pareira, 221
  peppermint, 527
  pilocarpus, 351
  pimenta, 433
  quassia, 364
  rhus glabra, 385
  rose, 266
  sanguinaria, 250
  sassafras, 235
  scoparius, 309
  senecio, 620
  serpentaria, 176
  spearmint, 523
  tansy, 627
  tea, 411
  triticum, 98
  valerian, 597
  viburnum prunifolium, 592
  wild cherry, 274
  zea, 89
Infus-um, -a, infusions, 20
  brayeræ, 270
  buchu, 343
  cocci, 633
  gentianæ compositum, 490
  oleum chamomillæ, 419
  rhei, 183
  rosæ acidum, 266
    compositum, 266
  senegæ, 371
  sennæ compositum, 297

Infusum, uvæ ursi, 465
Ingluvin, 647
Inhalations, inhalationes, 25
tolu, 305
Injectio apomorphinæ hypodermica, 246
cocainæ hypodermica, 338
morphinæ hypodermica, 246
Injections, hypodermic, 25
Inorganic drugs from mineral kingdom, 677
Inosite, 95
Insane-root, 543
Insect powder, Caucasian, Dalmatian, Persian, 627
Insecta, 631
Insufflations, insufflationes, 25
Insulin, 653
Inula, dysenterica, Helenium, squarrosa, 554, 617, 619
Inunct-um, -a, inunctions, 23
mentholis, 527
compositum, 527
Invertebrata, 631
Iodina rhombifolia, 498
Iodine, iodum, 703
swabs, 704
Iodoacetanilid, 933
Iodoantifebrin, 933
Iodoantipyrine, 948
Iodoform, 864, 917
Iodol, 865
Iodopyrine, 948
Ionidium Ipecacuanha, 590
Ipado, 334
Ipecac, Ipecacuanha, American, bastard, Brazilian, Carthagena, Columbian, farinaceous, Panama, Para, Rio, spurge, striated, undulated, white, wild, 272, 383, 584, 586, 590
Ipecacuanha, bastard, 499
Ipecanine, 586
Ipomea, Ipomœa, orizabensis, pandurata, purpurea, simulans, 501, 504, 506
Iris, florentina, fœtidissima, germanica, pallida, pseudacorus, versicolor, 101, 127, 128
Irish moss, 55, 58
Iron, Ferrum, 775
albuminized, albuminate, 785
and ammonium citrate, 784
tartrate, 790
and potassium tartrate, 790
and strychnine citrate, 790
arsenate, 789
bark tree, 431, 435
by hydrogen, 776
dialyzed, 789
filings, 788
peptonized (peptonate), 785
perchloride (sesquichloride), 777
protosulphate, 780
Quevenne's, 776
reduced, 776
subcarbonate, 788
wire, 776
Irritants, 46
Isaconitine, 205
Isinglass, American, Bengal, Ceylon, Chinese, Japanese, pipe, purse, 55, 646
Isoamylamine, 62
Isoemodin, 296, 393
Isolinoleic acid, 332
Iso-naphtol, 901
Isopilocarpine, 349, 351
Ivory-black, 685

J

Jaborandi, jamborandi, Isaborandi, false, Maranham, Pernambuco, 348, 349
Jaborine, 349
Jackob's-chariot, 204
Jalap, jalapa, fusiform, light, Tampico, true, Vera crux, wild, wood, 499, 500, 504, 506
Jalapin, orizabin, 502, 505
Jalapurgin, 502
Jambul, 428
James' powder, 837
Jamestown lily, weed, 548
Japanese, Chinese isinglass, 55, 646
Jateorhiza Calumba, palmata, 215, 218
Java plum, 428
Jelly plant, 55
Jennerian vaccine, 669
Jequirity, 319
Jervic acid, 103, 251
Jervine, 103
Jesuit bark, powder, 561
Jimson weed, 548
Juglandin, 154
Juglans, cinerea, nigra, regia, 154
Juice (Succus), apple, fresh, 281
belladonnæ, 539
chenopodium, expressed, 186
horehound, 515
hyoscyami, 547
lemon, 361
lime, 362
passiflora (inspissated), 414
stramonii, 550
taraxaci, 613
Juices, 25
Juniperus, Juniper, berry, bush, communis, Oxycedrus, Sabina, virginiana, 84, 85, 86, 87, 146

K

Kæmpferol, Kempferin, 295
Kalan tree, 415
Kalium, 705
carbonicum crudum, 706
Kalmia latifolia, 466
Kalumb, 217
Kamala, 376
Kaolin, Kaolinum, 773
Karoo buchu, 342

Kava kava, 149
Kayu-putu, 428
Kefir, 672
Keratin, 666
Kerlock, 252
Kermes, 634
  mineral, 838
Ketones, 938
Kickxia africana, 492
Kinnikinnick, 463
Kino, African, Australian, Bengal, Botany Bay, Caraças, E. India, eucalypti, Gambia, Jamaica, Malabar, Palas, W. India, 320, 321, 322
Kino-red, 322
Kinoin, 323
Kinovin, 574
Kissi, Kissine, 149
Kola, 407
Konseals, wafers, 24
Kosin, kosidin, kosotoxin, 270
Koumyss, kumyss, 65, 672
Kousso, 268
Krameria, argentea, cistroides, granatensis, Ixina, lanceolata, Para, Peruvian, secundiflora, tomentosa, triandra, 299, 300, 301, 302
  family, 299
Krameriaceæ, 52, 299
Kryptonine, 586

L

Labiatæ, 54, 508
Labiate (mint) family, 54, 508
Lac fermentatum, 65
  sulphuris, 691
  vaccinum, 671
Lachryma Papaveris, 236
Lacmus, litmus, 65
Lactophenin, 935
Lactose, lactosum, 663, 664
Lactuca, altissima, canadensis, elongata, sagittata, sativa, virosa, 613, 614
Lactucarium, gallicum, 613, 614
Lactyl-p-phenetidin, 935
Ladenbergia, 578
Ladies' glove, 553
Lady slipper root, 143
Lake, 633
Lamb's quarters, 187
Lamellæ, 25
  atropinæ, 539
  cocainæ (disks), 338
  homatropinæ, 539
  physostigminæ, 329
Lammint, 521, 524
Lana collodii, 402
Lanolin, lanolinum, 657
Lapides cancrorum, 635
Lapis calaminaris, divinus, infernalis, pierre divine (ophthalmique), 801, 809, 816
Lappa, 621
Lard, 650
Laricis—Veneta, 79
Larix, Europæa, Larix, Siberica, 78, 79, 475
Larkspur, field, 203
Laudanum, 245
Laughing gas, 682
Lauraceæ, 51, 222
Laurel, California Bay, 233, 236
  family, 222
Laurocerasi folia, 275
Laurus, nobilis, 233
Lavandula, common, garden, spica, spike, Stæchas, true, 511, 514
Lavati-o, -ones, 23
Lavender, lavandula, Arabian, drops, French, 511, 513, 514
Lavinus mellificus, 475
Laxatives, 43
Lead, 803
  acetate, 805
  carbonate, 807
  iodide, 807
  monoxide, oxide, 804
  nitrate, 808
  red, 807
  water, 806
Lecanora (tartarea), 65
Leeches, 634
Leek, 117
Leguminosæ, 52
Leiophyllum buxifolium, 464
Lemon peel, 358
Lemons, limones, 361
Leontodon, Taraxacum, 612
Leopards-bane, 619
Lepra bacillus, 417
Leptandra, leptandrin, 558, 559
Lerp, 475
Lettuce, garden, wild, 613, 614
Leucanthemum vulgare, 627
Leuko-alizarin, 944
Levatio ori, 477
Levulose, 94
Licorice, Indian, wild, 315, 319
Life everlasting, common, fragrant, sweet, 627
  root plant, 620
Light, 18
  magnesia, magnesium, 754
Lignum Colubrinum, 485
  vitæ, 340
Liliaceæ, 50, 107
Lily family, 107
Lily-of-the-valley, 120
Lime, 757
  carbonate, 766
  chlorinated, chloride, 758
  juice, 362
  oxymuriate, 758
  water, 757
Limonene, 354
Limonis cortex, 358
Limonium carolinianum, 466
Linaceæ, 52, 330

Linalool, 354
Linalyl acetate, 354
Lindera Benzoin, 233
Liniment, calcis, lime, 757
camphor, 230
chloroform, 861
soap, 477
soft soap, 333
tiglium, compound, 375
croton, compound, 375
turpentine, 77
Liniment -um, -a, liniments, 20
aconiti et chloroformi, 206
album, Stoke's, 77
belladonnæ, 539
calaminæ, 80
opii, 246
compositum, 77, 245
St. John Longs, 77
saponato-camphoratum, 477
saponis mollis compositum, 333
sinapis compositum, 255
terebinthinæ, 77
aceticum, 77
tiglii (crotonis), 375
Linseed, 331
Lint-bells, 331
Linum, usitatissimum, 331
Lion's mouth, 553
Liquid (cosmoline) vaseline, 843
Liquidambar orientalis, Styraciflua, 258
Liquor acidi chromici, 795
alumini acetatis, 806
subacetatis, 773
ammonii citratis, 749
antisepticus, 689
aromaticus alkalinus, 724
arsenicalis, Clemens, 833
auri bromidi et arseni, 701, 839
bismuthi et ammonii citratis, 814
calcis, 757
chlorinatæ, 759
saccharatus, 758
carbonis detergens, 79
carmini, 633
cocci, 633
ethyl nitritis, 881
ferri albuminati, 785
citratis, 782
perchloridi, 779
peptonati, 785
et mangani, 785
salicylatis, 779
formaldehydi saponatus, 855
guttæ perchæ, 466
hydrargyri nitratis, 829
perchloridi, 826
hydrastinæ compositus, 198
hypophosphitum compositus, 765
hypophysis, 671
iodi et zinci phenolsulphonatis, 704
phenolatus, 888
morphinæ acetatis, 246
hydrochloridi, 246
sulphatis, 246
Liquor morphinæ tartratis, 246
pancreatini, 652
pepsini, 653
antisepticus, 653
aromaticus, 653
phosphatum acidus, 696, 761
compositus, 696
phosphori, 695
picis carbonis, 79
potassii iodidi, 717
procainæ hydrochloridi, 884
rhei concentratus, 183
senegæ concentratus, 371
sodæ et menthæ, 728
sodii citratis, 728
boratis compositus, 724
phosphatis compositus, 734
silicatis, 687
thyroidei, 659
trinitrini, 854
Liquors, liquores, 20
Liriodendron Tulipifera, 188
Litharge, 804
Lithium, 743
benzoate, 744
bromide, 743
carbonate, 743
citrate, 744
salicylate, 745
Lithotriptics, 44
Liverwort, noble, 209
Lobelacrin, 607
Lobelia, bladder-podded, brown, cardinalis, great, green, inflata, syphilitica, 606, 608
Lobelin, 608
Lobeline, 607
Loco weed, 314
Logania family, 478
Loganiaceæ, 53, 478
Loganin, 480, 482
Logwood, 302
Loosestrife family, 420
Lophophora Lewinii, Williamsii, 420
Lordwood, 258
Losophan, 929
Loti-o, -ones, lotions, 23
alba veterinaria, 798
calaminæ, 801
composita, 801
plumbi et opii, 806
Lotion, Vleminckx, 758
Low Belia, 606
mallow leaves, 400
Loxopterygium Lorentzii, 498
Lozenge, benzoic acid, 471
lactucarium, 614
krameria, 301
and cocaine, 301
Lozenges, tablets, tabellæ, 22
Lucca (lecca), gum, 476, 477, 478
Luffa, ægyptiaca, Luffa, operculata, 600
Luminal, 883
Lunar caustic, 815
Lupulin, lupulinum, 169

Lycetol, 945
Lycium afrum, umbrosum, vulgare, 542
Lycopodiaceæ, 49, 70
Lycopodinæ, 49, 70
Lycopodium, clavatum, complanatum, 70, 72
Lycopus virginicus, 517
Lysol (lysolum), 929
Lythraceæ, 53, 420
Lytta vesicatoria, 636

M

Macis, Mace, 193
Macrotin, 202
Macrotys, 200
Madder, 590
  family, 561
Mad-dog, 510
Magm-a, -æ, 20
  magnesia, 753
Magnesia, calcined, heavy, magma, 753, 754, 755
Magnesium, 751
  carbonate, 753
    heavy, 756
  chloride, 755
  citrate, effervescent, 756
  light, 754
  oxide, heavy, 755
    light, 754
  sulphate, 752
    effervescent, 756
Magnolia, acuminata, glauca, tripetala, virginiana, 188
Maize, 87
Majoon, 168
Malaga nuts, 229
Mallee tree, 435
Mallotus philippinensis, 376
Mallow family, 397
Malt, maltum, barley, 96
Malus, Malus, 281
Malva rotundifolia, sylvestris, 400
Malvaceæ, 53, 397
Malvæ folia, 400
Mammalia, 648
Man of the earth, 506
  root, 506
Manaca, 551
Mandragora, autumnalis, officinalis, vernalis, 542
Mandrake, 210
Manganese, manganum, 792
  citrate, soluble, 792
  dioxide, 793
    precipitated, 793
  glycerophosphate, soluble, 793
  hypophosphite, 792
  sulphate, 794
Mango fruit, 414
Mangosteen, Mangostana, 362
  family, 411
Manihot, Manihot, utilissima, 91, 383
Manila elemi, 368
Manna, a cannola, Armenian, ash, Briançon, cannellata, communis, electa, fat, lachrymis, large flake, Persian, pinguis, small flake, sorts, Tamarisk, tears, tolfa, 472, 474, 475
Mannite, 474
Manzanita, 466
Maranta, arundinacea, 91, 138
Marble, marmor, 766
  -flower, 236
Marigold, 621
Marjoram, sweet, wild, 517
Marrubium, vulgare, 514
Marsdenia Condurango, 499
Marsh mallow root, 397
  rosemary, 466
Maruta Cotula, 625
Mass, ferrous carbonate, 782
  mercury, 820
  Vallet's, 782
Mass-a, -æ, masses, 20
  copaibæ, 290
Masterwort, 455
Mastiche, Mastic, 387
Maté, 391
Materia medica, 17
Matico, 148
Matricaria, Chamomilla, 618
Matzoon, 672
May apple rhizome, 210
  thistle, 622
Mayflower, 464
Mayweed, 625
Meadow saffron, 107
Meal berry, 463
Mealies, 87
Mecca balsam, gum, 368
Meconin, meconoiosin, 239
Meconium, 236
Medicago sativa, 535
Medicated pencils, 24
Medicines, administration of, age, 29
    condition of drug, 30
    conditions of individual, 30
    form of drug, 30
    incidental conditions, 30
    mode of, 29
  agents acting on circulatory system (circulation), 42
    on cutaneous system (skin) 46
    on digestive system (digestion), 42
    on excretory system (excretion), 43
    on nervous system (neurotics, nervines), 40
    on reproductive system (generation), 45
    on respiratory system (respiration), 41
  promoting constructive metabolism (metamorphosis), 38
    aliments, 38

Medicines, agents promoting constructive metabolism, antiperiodics, 38
antiphlogistics, 38
antipyretics, 38
digestive acids, 38
ferments, 38
fats, fatty oils, 38
febrifuges, 38
foods, 38
hematics, 38
restoratives, 38
tonics, 38
destruction of microbes, parasites, etc., 39
metabolism (metamorphosis), 39
arrangement of, by alphabetic sequence, 34
by chemical constituents, 34
by morphology and anatomy, 35
by natural affinities (botanical), 47
by therapeutic effect, 37
avenues of, 25
by arteries (transfusion), 27
by external application, 28
by lungs (respiration), 27
by rectum, 27
by skin, 26
endermic method, 27
enepidermic method, 27
epidermic (inunction) method, 27
hypodermic method, 26
hypodermoclysis, 26
by stomach, gastro-intestinal route, 25
by veins (intravenous injection), 27
cataphoresis, 28
classifications of, 34
conditions modifying dose and action of, 28
forms of, 19
incompatibility of, 31
chemical, 31
explosions, 32
pharmaceutical, 33
therapeutical, 33
transmission of, 28
untoward effects, 31
Mekilwort, 533
Mel, mella, mellita, 20, 640, 641
depuratum, 640
rosæ et sodii boratis, 724
sodii boratis, 724
Melaleuca, Cajeputi, Leucadendron, minor, 428
Melanthaceæ, 50, 102
Melia Azedarach, 369
Melilotus, melilot (yellow), 310
Melissa, officinalis, 517
Melon tree, 418
Menispermaceæ, 51, 215
Menispermum, canadense, palmatum, 217, 221
Mentha, aquatica, arvensis, canadensis, crispa, glabrata, hirsuta, longifolia, piperascens, piperita, Pulegium, rotundifolia, sativa, spicata, sylvestris, viridis, 517, 521, 523, 524, 526, 528
Menthol, 525, 526, 926
camphoratum, 527
plaster, 527
Menyanthes trifoliata, 491
Mercuramine, soluble, 830
Mercuric, chloride, corrosive, 822
cyanide, 830
iodide, red, 824
oxide, red, 829
yellow, 825
salicylate, subsalicylate, 826
subsulphate, yellow, 829
Mercurio vegetal, 551
Mercurochrome, 830
Mercurous, chloride, mild, 827
(mercury), iodide, yellow, 822
Mercury, 819
ammoniated, 823
bichloride, 822
biniodide, 824
mass, 820
oxide, precipitated, 825
perchloride, 822
protochloride, 827
protoiodide, 822
subchloride, 827
sulphide, red, 829
with chalk, 819
Meta-amido-para-oxybenzoate of methyl, 942
Meta-cresalol, 940
Metadihydroxybenzene, 895, 931
Metalloids and their compounds, 677
Metals and their compounds (salts), 705
Methacetin, 934
Methane, 916
Methanol, 919
Methenamine, 856, 920
Methenyl tri-chloride, 917
tri-iodide, 917
tri-bromide, 917
Methyl chloride, 916
hydroxide, 919
metamidoparoxybenzoate, 942
phenacetin, 906
salicylate, 461, 939
Methylacetanilid, 934
Methylal, 923
Methyl-benzoyl-ecgonine, 948
Methyl-cephaëline, 587
Methylconiine, 439
Methylene bi(di)chloride, 917
blue, 859
ditannin, 920
Methylene-dimethyl ether, 923
Methylmorphine, 242
Methyl-orthodioxybenzene, 892

Methyl-para-amido-meta-oxybenzoate, 942
Methylphenol, 891
Methyl-phenylacetamide, 934
Methyl-pyrocatechin, 892
Methylthionine chloride, 859, 917
Methysticum, 149
Metroxylon, Rumphii, Sagu, vitiese, 91, 99, 480
Mezereon, Mezereum, 419
Micrometer, 962, 963
Microscope, accessories, 953, 961
chromatic abberation, 957
compound, 954
directions for using, 960
estimating magnifying power, 960
in the drug store, 967
its use in materia medica, 953
objective, 956
ocular, or eye-piece, 954
requisites of, 958
simple, 953
spherical abberation, 958
Microscopic clearing, 966
hardening, 965
mounting, 967
softening, 966
staining, 967
Microtome, 961
Milfoil, 624
Milk, bismuth, 811
condensed, fermented, humanized, malted, 672
cow's, 671
magnesia, 753
sugar, 664
of sulphur, 691
Milkwort, 369
family, 369
Mimosa family, 281
Mimosaceæ, 281
Mint, brandy, brown, common garden, crisped-leaved, cross, curled, lady's, lamb, mackerel, water, 521, 523, 524
Mistur-a, -æ, mixtures, 21
adstringens, 806
carminativa, 754
chloralis et potassii bromidi composita, 858
chlorof. et morph. co., 861
copaibæ, 290
et opii, 290
mag. asafœt. et opii, 754
oleo-balsamica, 308
opii et chloroformi composita, 245
et rhei composita, 245
pectoralis, 749
rhei alkalina, 182
composita, 182
spiritus vini gallici, 850
Mitchella, repens, 590
Mixture, Basham's, 778
brown, 318
castor oil, 381
chalk, 762
Mixture, Chapman's, 290
glycyrrhiza, compound, 318
Griffith's, 367, 781
Lafayette, 290
neutral, 711
Molasses, melasses, 95
Momordica Balsamina, 600
Monarda punctata, 516, 519
Monardin, 516
Monkshood, 204
Monniera trifolia, 348
Mono-brom-ethane, 918
Monochlorethane, 865, 917
Mono-chlorinated hydrochloric ether, 918
Mono-chlor-methane, 916
Monocotyledones, 50, 87
Monosodium orthophosphate, 734
Moonseed family, 215
Moraceæ, 50, 165
Moringa aptera, pterygosperma, 561
Morning-glory family, 499
Morphine, morphina, chloride, hydrochloride, sulphate, 239, 240
Morrhua americana, 644
Morrhuol (gaduol), 645
Morus rubra, 172
Moschus, moschiferus, 660
Moss, Ceylon, club, clubfoot, Corsican, Iceland, running, worm, 55, 59, 65, 70
Moth-balls, 902
Mother cloves, 425
Motor depressants, 41
excitants, 41
Mountain balm, 507
box, 463
flax, 369
laurel, 466
mahogany, 460
tea, 460
Mousebane, 204
Mouth washes, 23
Mucilage, 164
acacia, 284
elm, 164, 165
gum arabic, 284
manna, 474
tragacanth, 314
Mucilago, mucilagines, mucilages, 21
chondri, 58
sassafras medullæ, 235
Mucuna pruriens, 325
Mugwort, Western, 612
Mulberry family, 165
red, 172
Mull-a, mull-æ, mulls, 23
acidi salicylici, 897
creosoti salicylata, 897
hydrargyri chloridi corrosivi, 823
zinci, 799
Mullein, clasping-leaved, flowers, great, leaves, 559, 560
Mulmul, 367
Mur, 367
Muscæ hispanicæ, 636

Muscal(e) buttons, 420
Muscarine, 66
Musk, Bucharean, Canton, Siberian, Tonquin, 660
Musk-root, 453
Mustard, black, flour, French, leaves, white, wild, yellow, 252, 253, 254, 255, 256
family, 251
foot-baths, 255
paper, 254
Mutton suet, 655
Mycoderma aceti, 870
Myroxylon, peruiferum, 308
Mydriatics, 41
Mylabris cichorii, phalerata, 639
Myotics, 41
Myrica, carolinensis, cerifera, 153
Myristica, argentea, fatua, fragrans, malabarica, 190, 191, 193, 194
Myristicaceæ, 51, 190
Myrosin, 254
Myroxocarpin, 308
Myroxylon punctatum, 306
Myrrh, myrrha, African, Arabian, gum, Herabol, Indian, Somali, Turkey, 366, 367
family (Frankinsense), 365
Myrrhin 367
Myrrhol, Myrrhenol, 367
Myrtaceæ, 53, 424
Myrtillin, 655
Myrtle family, 424

N

Naked ladies, 107
Napaconitine, 205
Napelline, 205
Naphtha coal, 886
Naphthalene, 902
derivatives, 901, 943
Naphthol, naphtol, 901, 943
Naphthol-aristol, 944
Naphthol-bismuth, 944
Naphtho-salol, 940
Naphthyl benzoate, 943
salicylate, 940
Narceine, 239, 244
Narcotics, 40
Narcotine, 239, 243
Nardostachys Jatamansi, 597
Nardus indica, spica celtica, 597
Naringin, 354
Narthex Asafœtida, 453
National Formulary, 18
Natural orders (families), 47
Nauclea, 578
Nebul-a, -æ, 23
aromatica, 888
eucalyptolis, 434
mentholis, 527
composita, 527
thymolis, 520
Neck (Nick) weed, 165
Nectandra Rodiæi, 232
Neoarsphenamine, 835, 926
Neokharsivan, 835
Neosaccharin, 906
Neosalvarsan, 835, 926
Nepeta Cataria, 511
Nerole Bigarade, petale, petit grain, Portugal, 354, 360
Nerotia flowers, 356
Nettle, stinging, 172
Neurotics, nervines, 40
Nicotiana, Persica, quadrivalvis, repanda, rustica, Tabacum, 551, 552
Niemeyer's pills for dropsy, 556
Nigger-head, 622
Night blooming cereus, 419
Nightshade, deadly, 533
fetid (stinking), 543
(potato) family, 530
sleeping, 533
Nitre, 717
Nitrobenzene, Nitrobenzol, 278
Nitrogen, 680
monoxide, 682
Nitrous ether, 924
oxide, 682
Nopalea cochinillifera, 632
Novarsenobenzol, 835
Novaspirin disalicylic ester of anhydromethylene citric acid, 940
Novocaine, 884, 949
Nutgall, 155
Nutgalls, American, Chinese, Japanese, 160
Nutmeg, Batavian, brown, butter, Dutch, false, limed, long, male, Penang, round, Singapore, unlimed, wild, 191, 192, 193, 194
family, 190
Nux metella, 479
vomica, Bombay, Calcutta, Ceylon, Cochin, Madras, 479, 480

O

Oak, barren, black, common European, cork, dyers, English, iron (Black Jack), Jerusalem, live, red Spanish, scarlet, Spanish, 161, 162, 163, 187
warts, 187
Oatmeal, 98
Oat, 95
Ocimum Basilicum, 572
Oculina virginea, 635
Oesipus, 655
Ohio curcuma, 194
Oil, allspice, 430
almond, bitter, synthetic, 278
expressed, 280
American wormseed, 185
anise, 443, 444
asafetida, 452
bay (myrciæ), 430

Oil, beach, 401
behen, ben, benne, 560, 561
bergamot, 361
birch tar, rectified, 155
bitter almond, 276
synthetic, 278
black pepper, 147
Brazil, 401
buchu, 342
cade, 85
cajuput, 428, 429
camphor, camphorated, 230, 232
capsicum, 532
caraway (carvon), 442
carbolized, 889
carron, 757
castor, cold-pressed, 378, 379, 380
chaulmoogra, 415, 416
chenopodium, 185, 186
cinnamon, 225
clove, 426
cocoanut, 101
cod-liver, 643, 644
copaiba, 290
coriander, 437, 438
cottonseed, clarified, refined, winter-bleached, 400, 402
croton, 372, 374
cubeb, 146
dwarf pine needles, 80, 81
ergot, 63
ethereal, 878
eucalyptus, 433
fennel, 446
gaultheria, 462
ginger, 131
ground-nut, 560
hemp, 169
hydnocarpus, 417
juniper, 84
tar, 85
lavender, flowers, 511, 512, 514
lemon, 360
linseed, 332
boiled, 334
Lukrabo, 417
mace, 193
mineral, white, 843
mirbane, 278
mustard, fixed, volatile, 253, 254
myristica, 193
myrrh, 367
Neat's-foot, 673
nerole, 354
nut, 378
nutmeg, 193
olive, 476
orange, essential, 357
palm, 100
seed, 328
para nut, 401
paraffin, 843
pea-nut, 560
pennyroyal, 517
pepo, 604, 605
Oil, peppermint, 525
petit grain citronnier, 360
pilocarpus, 351
pimenta, 430
plant, 378
ray, 646
rose (attar, essence, otto), 226
rosemary, 509
santal (sandalwood, santalwood, 472
santonica, 610
sassafras, 235
seed, 378
senega, 371
serpentaria, 176
sesame, 560
shark, 646
skate, 646
soy, 561
spearmint, 522
sperm, 646
star anise, 444
strophanthus, 493, 494
sweet, 475
orange, 357
tambor, 384
tar, rectified, 79
teel, 560
terpentine, rectified, 73, 75
theobroma, 404, 405
thyme, 518
tolu, 305
valerian, 596
Virgin, 475
vitriol, 692
whale, 646
wintergreen, 460, 939
Oil-cake, 334
Oils, infused, 23
Ointment, ammoniated mercury, 824
Basilicon, 77
belladonna, 538
blue, 820
boric acid, 689
brown, 807
calamine, 801
calomel, 828
capsicum, 533
carbolic acid, 888
chrysarobin, 324
citrine, 651
(hydrargyri nitratis), 821
diachylon, 804
Hebra's lead, 804
iodine, 704
stainless, 705
iodoform, 864
Kentish, 77
lead oleate, 804
mercurial, diluted, mild, stronger, 820
mercuric oxide, yellow, 825
nutgall, 158
petrolatum, 844
phenol, 888
rose water, 265

Ointment, simple, 651
staphisagria, 204
storax, 259
sulphur, 691
tannic acid, 158
tar, 78
white precipitate, 824
zinc oxide, zinc, 799
Old-man, 509, 612
Olea, 475
europæa, 475
infusa, 23
vermelho, 308
Oleaceæ, 53, 472
Oleate, aconitine, 206
cocaine, 338
mercury, 826
morphine, 246
Oleat-um, -a, oleates, 21
quininæ, 575, 872
veratrinæ, 106, 872
Oleoresin, aspidium, 69
capsicum, 532
ginger, 132
lupulin, 170
petroselinum, 441
Oleoresin-a, -æ, oleoresins, 21
cubebæ, 146
Oleosacchara, oil-sugars, 23
Ole-um, -a, oils, 21
adipis, 650
aurantii amari, 355
balænæ, 646
betulæ (volatile), 462
cardamomi, 137
ceti, 646
cocois, 101
fagi, 401
hedeomæ, 517
hepatis morrhuæ, 643
hyoscyami compositum, 547
infusum, 547
monardæ, 516
morrhuæ, 643, 644
myristicæ expressum, 193
nucistæ, 193
origani, 517
palmæ, 100
phenolatum, 889
phosphoratum, 695
rajæ, 646
ricini aromaticum, 388
rutæ, 340
squali, 646
succini rectificatum, 83
Olibanum, 368
Olive, 475
family, 472
fruit, wood, 478
gum, 476, 477, 478
leaves, 476
oil Castile soap, 477
Omphalea oleifera, 384
Onion, 117
Ononis spinosa, 319
Open-chain compounds, 916
Opium, Abkari, Asia Minor, Boston, Chinese, E. Indian, Egyptian, exhausted, factitious, granular, granulated, homogeneous, Persian, powdered, provision, thebaicum, Trebizond, Turkey, 236, 238, 239, 244, 245, 249
Opium-habit (disease), 248
Opium-test, 249
Opodeldoc, liquid, solid, 477
Opopanax Chironium, Opopanax, 449
Opsonic theory, 950
Opsonins, 950
Opuntia coccinellifera, 632
Orange, Curaçao, golden apple, navel, seedless, wild, 353, 356
Orchid family, 139
Orchidaceæ, 50, 139
Orchis masculà, 144
Ordeal bean, 326, 329
Ordeal-root, 479
Orexine hydrochloride, 946
Oriental hermodactyls, 112
Origanum, Majorana, vulgare, 517
Orizabin, 505
Orphol, 942
Orris root, Florentine, 127
Orthocaine, 942
Orthocresol, 892
Ortho-di-oxybenzene-methyl-ester, 892
Ortho-ethoxy-ana-mono-benzoyl, amido-quinoline, 946
Orthoform, 942
Orthoform-new, 942
hydrochloride, 943
Oryza sativa, 91
Os, 673
sepiæ, 635
Osmunda regalis, 68, 70
Ostrea edulis, virginiana, 634
Otolithus regalis, 646
Ourouparia Gambir, 578
Ovis aries, 655
Ox, 663
Ox-bile, 663
Oxgall, 663
Oxide, lead, semi-vitrified, 804
Oxy-quin-aseptol, 945
Oxyatropine, 537
Oxybenzoic derivatives, 939
Oxychinaseptol, 945
Oxygen, oxygenium, 680
Oxylinoleic acid, 332
Oxymel, oxymella, oxymellita, 23, 641
Oxytocics, 45
Oxytoluene, 891
Oyster-shell, 634

P

Pachyderma(l)-tous order (family), 649
Pachydermata, 649

Palaquium Gutta, oblongifolium, 466
Pale purple cone-flower, 617
Palma Christi, 378
Panax quinquefolium, 175, 436
Pancreatin, Pancreatinum, 650, 651
Pansy, 415
Papain, 418
Papaver, album, glabrum, nigrum, Rhœas, somniferum, 236, 237, 238, 249
Papaveraceæ, 51, 236
Papaverine, 239
Papaveris capsulæ, 249
Papayotin, 418
Paper-shell nuts, 279
Papier mouri, 364
Papilionaceæ, 52, 303
Para-acetanisidin, 934
Para-acetphenetidin, 905
Para-brom-acetanilid, 933
Paracetaldehyde, 857
Para-cresalol, 940
Para-cresyl-benzoate, 928
Para-diethoxyethenyl-diphenylamidine, 935
Para-ethoxyacetanilide, 905
Para-ethoxy-phenyl urea, 925
Paraffin, 916
  chlorinated, 847
  hard, 846
  soft, 844
Paraform, 855
Paraformaldehyde, 855
Paraguay tea, 391
Parahydroxyphenylethylamine, 62
Para-iodo-acetanilid, 933
Paraldehyde, 857, 921
Paramidobenzoic acid ethyl ester, 885
Para-oxybenzoic derivatives, 942
Para-oxy-metamethoxyallyl benzol, 427
Para-oxy-methyl-acetanilid, 934
Para-phenetol-carbamide, 925
Paraphthalein, 899
Parasiticides, 40
Paratoluenesulphondichloramide, 699
Para-valeryl-amido- (phenetol) phenetidin, 936
Paregoric, 246
Pareira, Brava, 219
Paricine, 220
Parillin, 125
Paris green, 809
Parsley family, 437
  fruit, 440
  Welsh, 165
Partridge berry, 460, 590
Parvules, Dosi-metric, 25
Pasque flower, 208
Passiflora incarnata, 418
Passion, flower (vine), 418
Pasta, betanaphtholis, 902
  dextrinata, 92
  resorcinolis fortis, 896
    mitis, 896
  zinci, 799
    (Lasser's), 897
Pasta zinci, mollis, 799
    sulphurata, 799
Pastæ dermatologicæ, 23
Paste, 22
Pastilli-us, pastilles, 22
Paullinia Cupana, 389, 584
Pawpaw, 418
Pea family, 303
Peach, 280
Peanut, 319
Pearl, white, 812
Pelletierine, tannate, 423
Pellitory root, 625
Pelosine, 220
Pennyroyal, American, European, 516, 517
Pental, 916
Pepo, 604
Pepper, Piper, African cayenne, American cayenne, bird, black, Cayenne, chilly, cockspur, cubeb, garden, goat's, Guinea, Java, long, pod, red, Spanish, tailed, white, Zanzibar, 144, 147, 149, 530
  family, 50, 144
Pepperbark, 428
Peppermint, 524
  camphor, 526
  tree, 435
Pepsin, Pepsinum, saccharatum, 650, 652, 653
Persian pellitory, 627
Persimmon, 467
Persio, 65
Peru-resinotannol, 308
Peruvian bark, compound tincture of, 575
Petrolatum, amber, liquid (paraffin), (heavy), (light), white, 843, 844, 845
Petroleum benzin, purified, 842, 843
  ether, 842
  jelly, 844, 845
    white, 845
Petroselinum, sativum, 440
Petrox, mercury, 821
Petroxolin-um, -a, petroxolins, 24
  betanaphtholis, 902
  bituminis sulphonati, 846
  cadinum, 86
  eucalyptolis, 434
  guaiacolis, 894
  phenolis camphoratum, 889
  spissum, 642, 844
  sulphuratum, 691
    compositum, 77, 691
Peucedanum graveolens, Ostruthium, 205, 449
Phanerogamia, 72
Pharmacodynamics, 17
Pharmacognosy, 17
Pharmacology, 17
Pharmacopœia, 18
Pharmacy, 17
Phaseolus, lunatus, multiflorus, vulgaris, 91, 328

Phaseo-mannite, 95
Pheasant's eye, 199
Phenacaine, 935
Phenacetin, phenacetinum, 905, 934
Phenacetin-urethane, 934
Phenazone, 908
Phenetidin quinine carbonic acid ester, 935
Phenetsal, 941
Phenobarbital, 883, 925
Phenocoll, hydrochloride, 936
salicylate, 937
Phenol, 886, 926
liquid, 888
red, 900
Phenolphthalein, 899
Phenolsulphonphthalein, 900
Phenyl salicylate, 898, 940
urethane, 924
Phenylacetamide, 904
Phenylbenzamide, 936
Phenyl-di-hydro-quinazoline hydrochloride, 946
Phenyl-ethylene, 259
Phenylethylmalonylurea, 925
Phenylformamide, 932
Phenyl-methyl-ketone, 938
Phenylpropyl cinnamate, 259
Phenzoline, 946
Pheretin, 296
Philosopher's stone, 20
Phlox, carolina, glaberrima, 487
Phosphorus, 694
Physeter macrocephalus, 646, 648
Physetolein, 645
Physostigma, cylindrosperma, venenosum, 326, 327
Physostigmine, 328
salicylate, 326, 328
Phytelephas macrocarpa, 480
Phytolacca, acinosa, americana, decandra, octandra, 187, 188, 535
Picea succinifera, 83
Pichi, 552
Picraconitine, 205
Picramnia pentandra, 364
Picrasma excelsa, 362, 363
Picrasmin (quassiin), 364
Picrotoxin, 218, 219
Pig weed, 187
Pill bearing spurge, 382
Pills, Aiken tonic, 777
asafetida, 453
Blaud's, 783
carbonate of iron, 782
chalybeate, 783
ferrous carbonate, 783
ferruginous, 783
iron, 783
mercurous, chloride, mild, compound, 828
phosphorus, 695
soap, compound, 478
squill, compound, 120
Vallet's ferruginous, 782
Pilocarpidine, 349
Pilocarpine, Pilocarpina, 348, 349, 350
hydrochloride, 348, 350
nitrate, 350
Pilocarpus, grandiflorus, heterophyllus, Jaborandi, Maranhani, microphyllus, pauciflorus, Pernambuco, pinnatifolius, Selloanus, spicatus, trachylophus, 348 349, 351, 352
Pilul-a, -æ, pills, 21
concentric, 21
enteric, 21
plumbi cum opio, 806
Pilulæ, aloes et asafœtidæ, 115
et ferri, 115
et mastiches, 115
et myrrhæ, 115
hydrarg. et podophylli, 115
podophylli compositæ, 115
aloini compositæ, 115
strychninæ et belladonnæ compositæ, 115
antiperiodicæ, 66
cambogiæ composita, 413
catharticæ vegetabiles, 603
digitalis et quininæ, 246
scillæ et hydrargyri, 556
ferri iodidi, 776
quininæ, aloes et nucis vomicæ, 781
strychninæ et arseni fortiores, 777
mites, 777
galbani composita, 454
ipecacuanhæ cum scilla, 588
laxativæ compositæ, 115
opii, 246
et camphoræ, 246
et plumbi, 246, 806
rhei, 183
compositæ, 183
Pimenta, acris, officinalis, 429, 430
Pimpinella, Anisum, magna, Saxifraga, 443, 445
Pinaceæ, 49, 72
Pine, broom, dwarf, frankincense, Georgia, ground, loblolly, long-leaved, mountain, old field, pitch, running, swamp, wild, yellow, 70, 73, 80, 81
Pinites, succinifer, 83
Pinkroot, 486
Pinus, alba, australis, Laricio, Larix, maritima, montana, palustris, Pinaster, Pumilio, rigida, rotundata, Strobus, sylvestris, Tæda, 73, 74, 78, 79, 80
Piper, album, angustifolium, Betel, caninum, Carpunya, citrifolium, Clusii, crassipes, Cubeba, Famechoni, hispanicum, Jaborandi, Lowong, longum, methysticum, Mollicomum, mollissinum, nigrum, officinarum, peltatum, reticulatum, ribesoides, umbellatum, unguiculatum, 144, 145, 147, 148, 149, 349, 530
Piperaceæ, 50, 144

Piperazidine, 945
Piperazine, 945
Pipmenthol, 526
Pipsissewa, spotted, 463, 464
Pisces, 643
Piscidia Erythrina, 320
Pistacia Lentiscus, Terebinthus, 80, 387
Pitch, Burgundy, Canada, hemlock, 82, 83
Pituitary, pituitarium, 670
Pix Burgundica, Canadensis, carbonis, liquidæ, lithanthracis, pini, 78, 79, 82, 83
Plaster, adhesive, 77, 642
belladonna, 538
blistering, 637
camphorated, mother, brown, 807
cantharidal, cantharides, 637
capsicum, 532
diachylon, 804
lead, 804
oleate, 804
litharge, 804
menthol, 527
mustard, 254
Platinic chloride, 840
Platinum, 840
Plum family, 272
Plumbum, 803
Poaya, 584
Poayeros, 586
Podophylli Indici rhizoma, 214
Podophylloquercetin, 212
Podophylloresin, 212
Podophyllotoxin, 212, 213
Podophyllum, Emodi, peltatum, 210, 214
Po(h) de Bahia, 323
Poison, black cherry, 533
ivy, 385
nut, 479
tablet of corrosive mercuric chloride, 823
tobacco, 543
Poisons, treatment and antidotes, 973
Poke root, 187
Polemonium reptans, 175
Polyarabinantrigalactan-giddic acid, 313
Polygala, alba, bitter, Boykinii, polygama, rubella, Senega, 369, 372
Polygalaceæ, 52, 369
Polygalin, 371
Polygama amara, 372
Polygonaceæ, 56, 177
Polygonatum commutatum (giganteum), multiflorum, 121
Polygonum, Bistorta, 184
Polypodiaceæ, 49, 67
Polypodium vulgare, 70
Polyporus (Boletus) fomentarius, officinalis, 65, 66
Pomegranate, (rind), 421, 424
Pompion, 604
Poppy, black seed, blue seed, capsules, maw seed, opium, papaver, petals red, prickly, white, yellow horned, 236, 249, 251
Poppy family, 236
Populi gemmæ, 153
Populus, acuminata, alba, angustifolia, balsamifera, candicans, nigra, tremula, 152, 153
Porteranthus, stipulatus, trifoliatus, 272
Potassa, sulphurated, 709
supertartrate of, 711
Potassium (Kalium), acetate, 709
acid carbonate, 707
and sodium tartrate, 712
bicarbonate, 707
bitartrate, 711
bromide, 714
carbonate, 706
impure, 722
chlorate, 713
chloride, 720
citrate, 710
effervescent, 710
cyanide, 721
dichromate, 722
ferrocyanide, 722
hydrate, 707
hydroxide, 707
hypophosphite, 719
iodide, 716
nitrate, 717
permanganate, 718
sulphate, 720
sulphite, 723
sulphuret of, 709
tartrate, 723
Potato fly, 639
Potentilla, canadensis, Tormentilla, 271
Pottasche, 706
Poultice, linseed, 333
Poultices, 22
Powder, anise, compound, 183
bleaching, 758
chalk, compound, 762
composition, 154
compound effervescing, 712
Dover's, 245, 588
glycyrrhiza, compound, 318
Goa, 323
gray, 819
Gregory's, 182
insect, 627
ipecac and opium, 245, 588
compound, 245, 588
jalap, compound, 502
James', 837
kino and opium, compound, 323
licorice, compound, 318
magnesia and rhubarb, 182
morphine, compound, 246
rhubarb, compound, 182
rubefacient spice, 427
Seidlitz, 712
tooth, oxidizing, 739
Tully's, 246
Premna traitensis, 102
Prescription-writing of the physician, 984

Prickly ash bark, berry, Northern, Southern 343, 344
elder, 435
Pride of India, 369
Princes' pine, 463
Prinos verticillatus, 391
Procaine hydrochloride, 884, 949
Proof spirit, 849
Prosopis juliflora, 284
Protargin, mild, strong, 817
Protargol, protargolum, 817
Protectives, 47
Protroveratrine, 103
Prune, Prunum, 275
Prunella vulgaris, 511
Prunus, armeniaca, domestica, Laurocerasus, obovata, Persica, rubra, serotina, virginiana, 272, 273, 275, 277, 280
Prussian blue, 790
Pseudaconitine, 205
Pseudoconhydrine, 439
Pseudojervine, 103, 104
Pseudomorphine, 239
Psoralea obliqua, 342
Psychotria emetica, 590
Psychotrine, 586, 587
Ptelea trifoliata, 352, 386
Pteridophyt(es)-a, 49, 67
Pterocarpin, 320
Pterocarpus, erinaceus, Marsupium, santalinus, 319, 320, 321
Ptychotis, Coptica, 519
Puke weed, 606
Pulicarea dysenterica, 617
Pulmonary sedatives, 41
Pulp capping varnish, 861
Pulsatilla, hirsutissima, patens, pratensis, vulgaris, 208
Pulvis, pulveres, powders, 21
acetanilidi compositus, 904
aloes et canellæ, 115
amygdalæ compositus, 280
antisepticus, 689
aromaticus, 193, 226
rubefaciens, 226
cretæ aromaticus, 762
et opii aromaticus, 762
elaterini compositus, 599
gambir compositus, 579
hydrargyri chloridi mitis et jalapæ, 828
myricæ compositus, 154
opii compositus, 246
pancreatini compositus, 652
rhei et magnesiæ anisatus, 183
talci compositus, 688, 897
Pumice stone, pumex, 688
Pumpkin seed, 604
Punica Granatum, 421
Punicaceæ, 53, 420
Punicine, tannate, 423
Purgatives, 43
Purging croton, 373
Purified animal charcoal, 685
kieselguhr, 687
Purified siliceous (infusorial) earth, 687
Purple avens, 271
Pustulants, 46
Pyramidon (-um), 909, 947
Pyrethrum, carneum, roseum, Tanacetum, 625, 627
Pyrocatechin, 322
Pyrocatechin-monomethylether, 893
Pyrodine, 938
Pyrogallol, 158, 932
Pyrola, chlorantha, elliptica, rotundifolia, 463
Pyroxylin, 402
Pyrozone, 679
Pyrrol tetraiodide, 865
Pyrus, Cydonia, Malus, 280, 281

Q

Quaker buttons, 479
Quassia, amara, excelsa, Jamaica, lofty, Simaruba, Surinam, 362, 363, 365
cups, 364
family, 362
Quassiin, 364
Quebracho, Colorado, floja, red, 498
Queen of the meadow, 616
Quercitron, 161
Quercus, Ægilops, alba, coccifera, coccinea, digitata, falcata, ferruginea, infectoria, lobata, marylandica, nigra, pedunculata, pubescens, Robur, sessiliflora, suber, tinctoria, Vallonea, velutina, virginiana (virens), 155, 156, 157, 160, 161, 162, 163, 475, 634
Quicklime, 757
Quicksilver, 819
Quillaja Saponaria, 268
Quillaja-sapotoxin, 268
Quinamine, quinami(n)a, 574
Quince, 280
Quinidine, Quinidina, 572
sulphate, 572
Quinine, Quinina, 567
acid sulphate, 568
and urea chloride, 571
hydrochloride, 571
bisulphate, 568
bromide, 569
carbo-phenetidide, 935
chloride, 569
dihydrochloride, 568
ethylcarbonate, 469, 949
flower, 491
hydrobromide, 569
hydrochloride, 569
bimuriate, 568
muriate, 569
neutral, 571
sulphate, 570
tannate, 571
tasteless, 571
Quinoidin, 574
Quinol, 932

Quinovic bitter, 574
Quinovin, 574

R

Rabbit's flower, 553
Radio-activity, 950
Radish, garden, wild, 256
Radix valerianæ majoris, 597
Ragwort, 620
Raja Batis, 646
Ranunculaceæ, 51, 194
Ranunculus, bullosus, 209
Rape, 256
Raphanus, Raphanistrum, sativus, 256
Raspberry, 267
Ratsbane, 479
Rattle root, 200
  weed, 314
Rattlesnake's root, 200
Recapitulation tables, (1) 150–151; (2) 262–263; (3) 346–347; (4) 458–459; (5) 528–529; (6) 628–629; (7) 674–675
Red ant, 642
  gum, 435
  precipitate, 829
  santal, 319
  Saunders, 319
  seaweed family, 55
Refrigerants, 43
Remijia, pedunculata, Purdieana, 578
Rennin, renninum, 665
Resin, Resina, 73, 74
  aloe, 115
  asafetida, 452
  copaiba, 290
  cubeb, 146
  guaiac, 340
  ipomea, 505
  jalap, 502
  Kauri, 83
  myrrh, 367
  pepo, 604, 605
  podophyllum (podophyllin), 212
  rhubarb, 181
  tolu, 305
Resin-a, -æ, resins, 21
  benzoe, 467
  benzoin, 470
Resins, cimicifuga, 202
Resolvents, 39
Resorcinol, resorcin, resorcin-ol, -um, 895, 931
Respiratory depressants, 41
  sedatives, 41
  stimulants, 41
Rest-harrow, 319
Rhamnaceæ, 52, 391
Rhamnoxanthin, 394
Rhamnus, californica, caroliniana, cathartica, Frangula, Purshiana, 146, 391, 392, 394, 395, 396
Rhaphidophora vitiensis, 102
Rhaponticum, 180
Rhatanic-red (ratanhia-red), 301
Rhatany, Antilles, Brazilian, brown, ceara, Florida, Guayaquil, New Granada, Para, Payta, red, Savanilla, Texas, violet, 299, 300, 301, 302
Rheum, australe, compactum, Emodi, hybridum, officinale, palmatum, rhaponticum, undulatum, 177, 180, 183
Rhigolene, 846
Rhodeoretin, 502
Rhœadine, 249
Rhœados petala, 249
Rhubarb, China, Chinese, crown, E. Indian, European, flats, rounds, Russian, torrefied, Turkish, 177, 178, 179, 180
Rhus, aromatica, copallina, Coriaria, diversiloba, glabra, hirta, japonica, pumila, radicans, semialata, Toxicodendron, typhina, venenata, Vernix, 160, 384, 385, 387
Richard(son)ia scabra, 590
Richweed, 200
Ricinus, communis, 378
Roccella (tinctoria), 65
Rochelle salt, 712
Rock candy, 95
Rock-rose, 414
Roentgen-rays, 950
Rohfilicin, 69
Roman vitriol, 808
Root, alum, 261
  angelica, 448
  bear's paw, (shield), 67
  bitter, 488
  colic, 126
  convallaria, 120
  eye, 194
  horseradish, 256
  Italian juice (wood), 315
  jaundice, 194
  lily-of-the-valley, 120
  liquorice, 315
  mechoacanna, 504
  Mexican scammony, 504
  mortification, 397
  Orizaba jalap, 504
  papoose, 214
  pleurisy, 498
  Queen's, 381
  rattlesnake, 369
  rheumatism, 126
  sangree, 175
  shield, 67
  shrub yellow, 200
  Spanish juice, 315
  squaw, 214
  turmeric, 194
  unicorn, 117
  vandal, 594
  wild yam, 126
  yellow (orange), 194
Roripa, Amoracia, 256
Rosa, blanda, canina, centifolia, damascena, gallica, nitida, 264, 266
Rosaceæ, 264

Rose, Damascus, dog, French, pale, Provins, red, 264, 266
family, 264
Rosemary, rosmarinus, 509
Rosmarinus officinalis, 509
Rottlera, 376
Rubber, 383
Rubefacients, 46
Rubi Idæi fructus, 267
Rubia tinctorum, 590
Rubiaceæ, 54, 561
Rubijervine, 103
Rubus, cuneifolius, Idæus, nigrobaccus, occidentalis, strigosus, villosus, 267, 268
Ruby wood, 319
Rudbeckia hirta, 622
Rue family, 341
Rumex, Acetosella, alpinus, britannica, crispus, obtusifolius, sanguineus, 183, 184, 488
Ruminant order (family), 655
Ruminantia, 655
Russian flies, 636
Ruta graveolens, 345
Rutabaga, 256
Rutaceæ, 52, 341
Rutin, 343
Rye, cockspur, ergot of, honey-dew, mother of, smut of, spurred, 60, 61

S

Sabadilla, 105
Sabbatia, angularis, campestris, Elliottii, 491
Saccharin, 906, 939
soluble, 907
Saccharomyces (Torula) cerevisiæ, 64
Saccharum, crystallizatum, hordeatum, officinarum, ustum, 92, 95
Safflower, 627
Saffron, cake, hay, 128, 129
Safrol, Safrolum, 235
Sage, meadow, of Bethlehem, 515, 521
Sago, pearl, 91, 99
St. Andrew's lace, 165
St. Ignatius bean, 484
Sal diureticus, 709
lithii citratis effervescens, 744
magnesii sulphatis effervescens, 753
potassi bromidi effervescens compositum, 715
Salacetol, 941
Salantol, 941
Salazolon, 947
Salep, 144
Sal-ia effervescentia, 24
Salicaceæ, 50, 152
Salicin, Salicinum, 152
Salicitrin, 940
Salicyl aldehyde-methyl-phenyl-hydrazine, 939
Salicylic derivatives, 939
Salicylism, 897
Salinaphthol, 940
Saline purgatives, 43
Salipyrine, 947
Salix, alba, fragilis, purpurea, 152, 153
Salizine, 939
Salocoll, 937
Salol, 898, 940
Saloop, 233
Salophen, 941
Salt, Carlsbad, artificial, effervescent, 728
common, sea, table, 725
Epsom, 752
Glauber's, 732
Kissingen, artificial, effervescent, 721
lemon, 874
of Tartar, 706
sorrel, 874
Vichy, artificial, effervescent, 707
volatile, 748
Saltpetre, 717
Chile, 739
Salvarsan, 834, 926
Salve, 22
Deshler's, 77
mother's, 807
Salvia, lyrata, officinalis, polystachya, pratensis, 515, 516
Sambucus, canadensis, Ebulus, maderensis, nigra, 590, 591
Sand myrtle, 464
Sandal, yellow, 172
Sandalwood family, 172
Venezuela, white, 172, 174
Sandarac, Sandaraca, 83
Sangrel, Snagrel, 175
Sanguinaria, canadensis, 249
Sanguinarine, 251
Sanguis, 673
Sanguisuga, medicinalis, officinalis, quinquestriata, 634
Santal, 320
Santalaceæ, 51, 172
Santalin, 320
Santalum, album, austro-caledonicum, Freycinetianum, pyrularium, rubrum, Yasi, 172, 174, 319
Santonica, 609
Santonin, Santoninum, 609
Santoninic acid, 610
Sap green, 396
Sapindus, marginatus, Saponaria, 390
Saponin, 268, 371
Sarsaparilla, bearded, Brazilian, Central American, Costa Rica, false, German, Guayaquil, Honduras, Jamaica, Lima, Lisbon, mealy, Mexican, non-mealy, Para, red, Rio Negro, Tampico, Vera Cruz, Virginian, wild, 122, 123, 124, 125, 126, 436
Sarsasaponin, 125
Sassafras, lignum, medulla, pith, radix, variifolium, wood, 233, 234, 236

Sassafrid, 235
Satin wood, 345
Saunders, white, 172
Savin, 86
Saw palmetto (berries), 98
Saxifrax, 233
Scabiosa arvensis, succisa, 595
Scales, 25
Scammony, 504
Scheele's green, (copper arsenite), 810
Scilla, 117
Scillin, Sinistrin, 119
Scillitin, Scillipicrin, 119
Sclererythrin, 60, 62
Scleromucin, 62
Scopola, carniolica, japonica, 535, 541, 542
Scopolamine, 544, 545
bromide, 545, 546
hydrobromide, 545
Scotch fir, 80
mercury, 553
Scrophulariaceæ, 54, 552
Scutellaria, galericulata, integrifolia, lateriflora, pilosa, 510, 511
Sea onion, 117
Seaweeds, 55, 56, 57, 58
Secale clavatum, 60
Sedatin, 936
Sedatives, 40
Seed, cardamom, 134
hemp, 169
kuli, 374
larkspur, 203
maw, 249
Mexico, 378
strophanthus, false, 495
Selenicereus grandiflorus, 419
Self-heal, 511
Semen Bardanæ, 622
lycopodii, 70
nucis vomicæ, 479
quercus tostum, 163
Semi-alteratives, 39
Senecio, aureus, 620
Senega, Seneka, false, Texas, white, 369, 372
Senegin, 371
Senna, Aden, Alexandria(n), Arabian, Baladi, Bombay, E. India, India(n), Jamaica, Jebeli, Mecca, Mocha, mountain, Nubian, Port Royal, Tinnevelly, Tripoli, wild, 292, 293, 294, 295, 298
family, 287
Senna-rhamnetin, 296
Sennacrol, 296
Sennanigrin, 295
Sennapicrin, 295, 296
Sepia officinalis, 635
Serenoa, serrulata, 98
Serpentaria, 175
Serpentary, 175
Serronea, Jaborandi, 349
Serum antidiphthericum, 667
Serum, antitetanic, crude, 669
antitetanicum, 669
purificatum, 668
Sesamum indicum, 560
Seven-barks, 260
Sevum, 655
benzoinatum, 656
bovinum, 656
præparatum, 655
Setwall, 594
Sheep, 655
sorrel, 184
Shikimi, 190
Shin-leaf, 463
Shittim wood, 391
Shrubby trefoil, 352
Sialagogues, 42
Siddhi, sidhee, subjee, 168
Silicon, silicium, 686
Silk cotton family, 404
Silkweed, 498
Silky cornel, 457
Sillitoxin (scillain), 119
Silver, Argentum, 815
cyanide, 818
iodide, 818
nitrate, 815
diluted, 819
fused, 816
mitigated, 819
moulded, 816
oxide, 818
vitellin, 817
Silver-protein, mild, strong, 817
Silybum Marianum, 622
Simaba cedron, 365
ferruginea, 365
Simaruba, amara, excelsa, medicinalis, officinalis, 363, 365
Simarubaceæ, 52, 362
Simple purgatives, 43
Sinapine, sulphocyanide, 253, 254
Sinapis, alba, nigra, nigræ semina, 252, 253, 255
Sinigrin, 254
Sitsea citrata, 145
Sium latifolium, 595
"606," 834
Skullcap, 510
Skunk cabbage, 101
Small viburnum (black haw), 593
Smallpox vaccine, 669
Smilaceæ, 50, 121
Smilacin, 125
Smilacina racemosa, 121
Smilasaponin, 125
Smilax, aspera, china, glauca, medica, officinalis, ornata, papyracea, pseudo-china, syphilitica, tamnoides, utilis, 91, 122, 123, 125, 126
family, 121
Snakeroot, snakeweed, Canada, Red River, seneca, senega, Texas, Virginia, 175, 176, 369
button, 440

Snow (permanent) white, 767
Soap, 477
green, soft, 333
Soapstone, 687
Soda, mint, 728
Sodii borobenzoas, 724
Sodium, Natrium, 723
acetate, 729
arsenate, 736
exsiccated, 737
solution, 737
benzoate, 730
biborate, 724
bicarbonate, 727
biphosphate, 734
bisulphite, 740
borate, 724
bromide, 730
cacodylate, 735
carbonate, 739
dried, 740
monohydrated, 726
chlorate, 740
chloride, 725
citrate, 729
cyanide, 741
diethylmalonylurea, 883
dihydrogen phosphate, 734
dimethylarsenate, 735
di-thio-salicylate, 939
glycerophosphate, 738
hydrate, 728
hydrocarbonate, 727
hydroxide, 728
hypophosphite, 738
hyposulphite, 736
indigotindisulphonate, 726
iodide, 731
muriate, 725
nitrate, 739
nitrite, 735
orthophosphate, 733
paratoluenesulphonchloramide, 698
perborate, 739
phenolsulphonate, 741
phosphate, 733
effervescent, 734
exsiccated, 733
pyroborate, 724
pyrophosphate, 742
salicylate, 732
santoninas, 610
santoninate, 742
sulphate, 732
sulphite, exsiccated, 742
sulpho-ichthyolate, 846
tetraborate, 724
thiophene-sulphonate, 926
thiosulphate, 736
Soja bean, 325
hispida, 325, 561
Solanaceæ, 54, 530
Solanum, carolinense, Dulcamara, nigrum, paniculatum, tuberosum, 91, 535, 540, 541
Solenostemma Argel, 294
Solidago odora, 623
Solomon's seal, American, European, false, 121
Soluble gun cotton, 402
Soluti-o, -ones, solutions, 24
mastisches chloroformica composita, 388, 861
resinæ chloroformica, 77
Solution, ammonium acetate, 748
hydroxide, 680
arsenic chloride, 832
arsenous acid, 832
and mercuric iodide, 825
bleaching, 758
boroglyceride, 689
Burow's, 773
calcium hydroxide, 757
caustic potash, 708
chlorinated soda, 758
surgical, 759
cresol, compound, 892
Dakin's, modified, 759
dental anesthetic, 884
Dobell's, 724
Donovan's, 825
elaterium, 599
epinephrine hydrochloride, 658
ferric chloride, 777
subsulphate, 787
sulphate, (tersulphate, normal), 781
formaldehyde, 855, 920
Fowler's, 833
hydrastine, colorless, 898
hydrogen dioxide, 679
peroxide, 679
iodine, carbolized, 704
compound, 704
iron and ammonium acetate, 778
perchloride (muriatici oxydati), 777
Labarraque's, 758
lead subacetate, 805
lime, 757
Lugol's, 704
magnesium citrate, 755
Majendie's, 246
Monsel's, 787
morphine, 246
pituitary, 671
body, 671
potassa, 708
potassium arsenite, 833
citrate, 711
hydrate, 708
hydroxide, 708
saline, normal, 725
salt, physiological, 725
soda, 728
sodium arsenate, 737
Pearson's, 737
chloride, physiological, 725
hydrate, 728
hydroxide, 728

Solution, tenth-normal oxalic acid volumetric, 874
Vleminckx, 758
zinc chloride, 797
Somnal, 925
Somnificants, 40
Soporifics, 40
Sorghum vulgare, 96
Southern buckthorn, 396
Southern-wood, 612
Sozoiodol, 927
Spadic, 334
Spanish broom, 309
flies (fly), 636
needles, 622
Sparteine sulphate, 309
Spartium junceum, 309
Spathyema fœtida, 101
Spearmint, 521
Species, Emollientes, 24, 48, 399
laxativæ, 297
pectorales, 399
Sperm whale, 648
Spermaceti, 648
Spermatophyt(es)-a, 49, 72
Sphærococcus lichenoides, 59
Spica nardi, 597
Spice berry, 460
Spigelia, anthelmia, marylandica, 175, 486, 487
Spigeline, 487
Spignet, 435
Spinants, 41
Spindletree, 389
Spiny clotbur, 623
Spiræa, tomentosa, 272
Spirit, ammonia, aromatic, 681
fetid, 453
anise, 445
ants, 643
camphor, 230
chloroform, 861
cinnamon, 226
colonial, 919
Columbian, 919
ethyl nitrite, 880
French wine, 850
gaultheria, 462
glonoin, 853
glyceryl trinitrate, 853
hartshorn, 680
juniper, compound, 85
lavender, 513
compound, 513
lemon peel, 361
methylated, 919
Mindererus, 748
nitre, 880
nitroglycerin, 853
nitrous ether, 880
orange, compound, 358
peppermint, 526
pyroacetic, 866
pyroligneous, 919
rosemary, 510
Spirit, (sea) salt, 700
spearmint, 523
turpentine, 73
wine, 848
wood, 919
Spirits, juniper, 85
compound, 85
of volatile oils , 24
Spiritus, spirit, spirits, 21
acidi formici, 643
ammoniæ, 681
anisatus, 445
amygdalæ amaræ, 277
cajuputi, 429
melissæ compositus, 517
myrciæ compositus, 431
myristicæ, 193
odoratus, 355
sinapis, 255
vini vitis, 850
Split nut, 326
Sponge, burnt, 634
Spongia, officinalis, usta, 634
Sprays, 23
Spreading dogbane, 497
Spurge family, 372
Squalus Carcharias, 646
Squaw vine, 590
Squaw-weed, 620
Squawroot, 200
Squill, red, white, 117, 118
Squirrel corn, 251
Stag's horn, 662
Staphisagria, 203
Star grass, 117
Starch, bean, Cassava, corn, curcuma, euphorbia, iodized, maranta, oat, potato, rice, sago, sarsaparilla, tapioca, wheat, 87, 89, 91, 99
Statice limonium, 466
Stili, acidi salicylici, 92, 897
medicamentorum, 24
Stillingia, sebifera, sylvatica, 381, 382
Stimulants, 40
Stink-weed, wort, 548
Sterculiaceæ, 53, 404
Stercus diaboli, 450
Sternutatories, 42
Stokes' expectorant, 749
Stone-root, 527
Storax, American, Levant, 258
family, 467
Storesin, 259
Stork's-bill, 330
Stovaine, 949
Stramonium, 548
Strawberry bush, 389
Streptococcus antitoxin, 671
Stringy-bark tree, 435
Strontium, 769
bromide, 770
iodide, 770
lactate, 770
salicylate, 769
Strophanthin, strophanthinum, 493

Strophanthus, Courmonti, dichotomus, gratus, hispidus, Kombé, Nicholsonii (asper), 492, 495
Strychnine, strychnina, nitrate, sulphate, 480, 481
Strychnos, Castelnæana, Colubrina, Ignatii, nux-vomica, potatorum, Tieute, toxifera, 352, 479, 485
Stypticin, 243
Styptics, 46
Styptol, 244
Styraceæ, 53, 467
Styracol, 931
Styrax, storax, Benzoin, calamita, liquid, officinalis, 258, 260, 467
Styrene, Styrolene, 259
Styrian monkshood, 204
Styrol, 259
Styrone, styracin, 259
Sublamine, 830
Succinum, 83
Succ-us, -i, 25
  juniperi inspissatus, 85
  pomorum, 281
  thebaicus, 236
Sucrol, 925
Sucrose, sucrosum, cane sugar, 92
Sudorifics, 44
Suet, prepared, 655
Sugar, barley, burnt (coloring), cane, fruit, loaf, Muscavado, open pan, raw, refined, vacuum pan, 92, 93, 94, 95
  of lead, 805
Sulphaminol, 928
Sulphate of atrophia, 537
Sulpho(carbol) phenol, 927
Sulphomethane, 923
Sulphonal, sulphonalum, 867, 923
Sulphonethylmethane, 868, 923
Sulphonmethane, 867
Sulphur iodide, 692
  liver of, 709
  precipitated, 691
  sublimed, 690
  washed (lotum), 690
Sumac(h), berries, black, dwarf, European, fragrant, mountain, Pennsylvania, scarlet, sleek, smooth, staghorn, sweet-scented, upland, 384, 385
  family, 384
Sumbul, 453
Sundew, 256
Suppositori-um, -a, suppositories, 21
  acidi carbolici, 889
  belladonnæ, 539
  boroglycerini, 689
  iodoformi, 864
  morphinæ, 246
  plumbi composita, 806
Suppositories, glycerin, 853
Supracapsulin, 657
Suprarenalin, 657
Sus scrofa, domesticus, 650
Swamp dogwood, 352
  milkweed, 498
Swartzia decipiens, 348
Sweet, bay, 233
  cumin, 443
  flag, 101
  gum, 258
  orange peel, 356
  scabious, 623
  spirit of nitre, 880
  weed, 397
  wood, 315
Swertia, angustifolia, Chirayita, pulchella, 490, 491
Sycocarpus Rusbyi, 368
Symphytum officinale, 554
Symplocarpus fœtidus, 101
Synaptase, 276
Syncaine, 884
Synthalin, 655
Syrup, Syrupus, 94
  acacia, 285
  almond, bitter, 277
  cascara, aromatic, 394
  citric acid, 875
  cocillana, 369
  Easton's (ferri, quininæ et strychninæ phosphatum), 785
  eriodictyon, 508
  ferrous iodide, 779
  fuscus, 95
  ginger, 132
  hydriodic acid, 717
  ipecac, 588
  lactucarium, 614
  lemon (juice), 361
  orange, 357
    flowers, 355
    peel, 357
  pine tar, 79
  quinidine, bitterless, 572
  rhubarb, 182
    aromatic, 183
  sarsaparilla, comp., 126
  senega, 371
  senna, 297
  squill, 119
    compound, 119, 120
  tolu, 305
  wild cherry, 274
Syrup-us, -i, syrups, 21
  acidi citrici, 361
  allii, 116, 117
  althææ, 399
  ammonii hypophosphitis, 750
  asari compositus, 177
  bromidorum, 715
  cacao, 407
  calcii et sodii hypophosphitum, 738, 765
    hypophosphatis, 765
    iodidi, 761
    lactophosphatis, 764
      et ferri, 764, 765
  calcis, 758

Syrupus, chloral, 858
cinnamomi, 226
codeinæ phosphatis, 246
eriodictyi aromaticus, 508
ferri phosphatis, 776
saccharati solubilis, 778, 787
ficus compositus, 172
fuscus, 95
glycyrrhizæ, 318
hypophosphitum, 765
compositus, 765
iodotannicus, 158, 704
ipecacuanhæ et opii, 588
krameriæ, 301
mannæ, 474
phosphatum compositus, 766
cum quinine et strychnina, 766
pini albæ compositus, 80
cum morphina, 80
rhamni catharticæ, 396
rosæ, 265
rubi, 267
sennæ aromaticus, 297
stillingiæ compositus, 382
thymi compositus, 520
trifolii compositus, 311

T

Tabell-a, -æ, tablets, 24
carbonis animalis, 685
compressed, 24
phenolphthalein, 900
santonini, 610
compositæ, 610
sodii bicarbonatis, 728
trinitrini, 854
Table comparing metric and apothecaries' fluid measure, 987
avoirdupois, and apothecaries' weights, 787
constituents, 998
corresponding values, 987
doses of rare drugs, 989
drops in fluiddrachms, 991
Fahrenheit and Centigrade equivalents, 993
maximum doses, 988
measures of approximation, 988
medical abbreviations, 994
pronunciation of important words, 999
rules for converting diminutive measurements, 988
weight of fluiddrachms in grains and grammes, 991
of liquids, 988
Tablet triturates, 24
Tablets, calomel, 828
soda mint, 728
Tænifuges, tenifuges, 45
Talc, purified, 687
Tamarind, 291
Tamarindus indica, 291
Tamarix, africana, articulata, gallica, mannifera, orientalis, 160, 475
Tampicin, 506
Tanacetum, Balsamita, crispum, vulgare, 626, 627
Tannalbinum, 647
Tannigen, 871
Tannin, 157
Tannoform, 920
Tannyl acetate, 871
Tansy, 626
Tapioca, 91, 383
Tar, coal, pine, 78, 79
weed, 507
Taraktogenos Kurzii, 415, 417
Taraxacum, 612
Tartar emetic, 836
Tartarian Southern wood, 609
Tartrated antimony, 836
Tea, 409
berry, 460
black, green, 409
breast, 399
British, 164
family, 409
Jerusalem, Jesuit, 185
Mexican, 187
Paraguay, 391
St. Germain, 297
Teleost(eæ)-ia, 643
Teleostean order (family), 643
Tephrosia apollinea, 294
Terchloride, formyl, 860
Terebene, 76, 926
Terebinthina, Argentoratensis, canadensis, China, communis, 73, 80, 82
Terminalia angustifolia, 469
Ternstrœmiaceæ, 53, 409, 580
Terpenes, 926
Terpin hydrate, 76, 78, 926
Terra alba, 767
Japonica, 578
Testa, ovi, 634, 647
Tetanus antitoxin, 668
concentrated, purified, 668
crude, 669
refined, 668
unconcentrated, 669
unrefined, 669
Tetrachlormethane, 686
Tetra-hydro-para-quin-anisol, 946
Tetramethylthionine hydrochloride, 859
Tetronal, 923
Thalline, sulphate, tartrate, 946, 947
Thallophyt(es)-a, 49, 55
Thea Bohea, drupifera, japonica, oleosa, sinensis, viridis, 409, 411, 580
Theaceæ, 53, 409, 580
Thebaica, 236
Thebaine, 239
Theine, thea, 409, 580, 948
Theobroma, Cacao, 404
Theobromine, 405, 407, 408, 948
sodio-salicylate, 406, 948
Theocine, 409

Theophylline, 409
Therapeutics, 18
Thermodin, 934
Thimbles, 553
Thio-oxy-diphenylamine, 928,
Thiophene derivatives, 926
Thiophene-di-iodide, 926
Thioresorcin, 932
Thiosinamin, 925
Thorn-apple, entire-leaved, purple, 548, 551
Thorny clotbur, 623
Thoroughwort, 615
Three-leaved hoptree, 386
Thridace, 614
Throatwort, 553
Thuja, occidentalis, 80
Thus Americanum, 73
Thymacetin, 521
Thyme, thymus, common garden, mother of, 518
Thymol, inhalation, 519, 520
iodide, 894, 929
Thymus vulgaris, 518, 519
Thyreoidectin, 660
Thyroid, thyroideum, 659
Thyroideum siccum, 659
Thyroxin, thyroxinum, thyrox, 659
Tickle (itch) weed, 103
Tin (stannum), 838
Tinctur-a, tinctur-æ, tinctures, 22
Ætheræ, ethereal, 22
aloes, 115
et myrrhæ, 115
amara, 490
antimonii, 836
antiperiodica, 66
arnicæ, 620
aromatica, 226
bryoniæ, Homeopathic, 600
cacti grandiflora, 419
calendulæ, 621
chloroformi et morphinæ composita, 861
cimicifugæ, 202
cinnamomi, 226
cocculi, 218, 219
colchici, 111
cormi fortis, 111
cubebæ, 146
delphinii, 203
ferri chloridi ætherea, 778
pomata, 281
gallæ, 158
gelsemii, 486
guaiaci, 340
ammoniata, 340
composita, 340
Dewees', 340
humuli, 169
hydrastis, 197
Ignatiæ, 485
ipecacuanhæ, 588
et opii, 588
jalapæ, 503
Tinctura, jalapæ, composita, 503, 506
lobeliæ æthera, 608
medicamentorum recentum, 22
opii ammoniata, 246
crocata, 245
passifloræ, 418
persionis composita, 65
pilocarpi (jaborandi), 351
pruni virginianæ, 274
pulsatillæ, 208
quassiæ, 364
rhei aquosa, 183
aromatica, 193
dulcis, 183
et gentianæ, 183
sabal et santali, 99
sanguinariæ, 250
saponis viridis composita, 333
senegæ, 372
serpentaria, 176
sumbul, 454
viburni opuli composita, 593
Tincture, aconite, 206
Flemings', 206
asafetida, 453
belladonna, 539
benzoin, 471
compound, 471
bitter orange peel, 355
boldus, 222
buchu, 343
calumba, 217
camphor, 230
compound, 246
cannabis, 167
cantharides, 638
capsicum, 532
cardamom, 137
compound, 137
cascara, 394
caulophyllum, 214
cinchona (Peruvian bark), compound, 575
clove, 428
coca, 338
colchicum, 111
colocynth, 603
coptis, 199
cudbear, compound, 65
digitalis, 556
Dover's powder, 588
eucalyptus, 434
ferric chloride, 778
gambir, compound, 579
gentian, compound, 489
green soap, 333
henbane, 547
hyoscyamus, 547
iodine, 704
Churchill's, 705
decolorized, 704
iron, tasteless, 779
kino, 323
and opium, compound, 323
kola, 408

Tincture, krameria, 301
lactucarium, 614
lappa, 622
lavender, compound, 513
lemon, 360
lobelia, 607
lupulin, 170
matico, 148
musk, 661
myrrh, 367
Norwood's, 105
nux vomica, 483
of fresh drugs, 22
opium, 245
camphorated, 246
deodorized, 245
pale catechu, compound, 579
physostigma, 329
phytolacca, 188
podophyllum, 213
pyrethrum, 626
rhubarb, 182
aromatic, 182
Spanish flies, 638
squill, 120
stramonium, 550
staphisagria, 204
strophanthus, 494
sweet orange peel, 357
tolu, 305
valerian, 596
ammoniated, 596
veratrum viride, 104
Tobacco, Tabacum, Indian, wild, 551, 552, 606
Tochlorine, 698
Tokoroten, 56
Tolamine, 698
Tolu, 303
Toluifera, Balsamum, Pereiræ, 303, 306
Tonga, tongine, 102
Tonka bean, 325
Tooth powders, 23
Tormentil, 271
Touch wood, 66
Toughened caustic, 816
Tous-les-mois, 139
Toxicology, 18
Toxitabellæ, 22
Tragacanth, Tragacantha, common, flake, leaf, Smyrna, sorts, vermicelli, vermiform, 311, 313
Tragacanthan-xylan-bassoric acid, 313
Traganton, 313
Trailing arbutus, 464
Tree, alligator, 258
amboyna kino, 320
araroba, arariba, 323
gum, 258
camphor, 228
Indian, 282
Oriental sweet, 258
of Heaven, 294
quino-quino, 306
spice, 236
Tree, storax, 258
Trehala, 475
Tri-brom-phenol, 926
Trichlorbutyl alcohol, 863
Trichlorbutylaldehyde-hydrate, 921
Tricresol, 891
Trifolium, pratense, 310
Triformol, 855
Trigonella Fœnum-græcum, 311
Trigonelline, 493
Tri-hydroxybenzene, 932
Tri-iodo-meta-cresol, 929
Triiodomethane, 864
Trillium, erectum, 121
Tri-methyl-ethylene, 916
Trinitrophenol, 900
Trional, trionalum, 868, 923
Triosteum perfoliatum, 585, 593
Tri-oxy-acetophenone, 938
Trioxymethylene, 855
Tristanes knot, 165
Triticum, æstivum, 91, 98
Triturati-o, triturati-ones, triturations, 22
Trituration, elaterin, 599
Troches, ammonium chloride, 747
cubeb, 146
gambir, 579
glycyrrhiza and opium, 246
morphine and ipecac, 246
peppermint, 527
tannic acid, 158
Trochisci carbonis ligni, 684
eucalypti gummi, 435
ipecacuanhæ, 589
morphinæ, 246
santonini, 610
sodii santoninatis, 610
ulmi, 165
Trochisc-us, trochisc-i, troches, 22
acidi carbolici, 889
Tropacocaine hydrochloride, 949
Tsuga canadensis, 83
Tulip-tree, 188
Turkey corn, 251
Turlington's balsam, 471
Turmeric, 134
Turnera, aphrodisiaca, diffusa, 417
Turnip, Swedish, 256
Turpentine, Canada, Chian, crude, European, Strassburg, Venice, 79, 80, 82
Turpeth mineral, 829
Tussilago Farfara, leaves, 619
Tyramine, 62

U

Ulmaceæ, 50, 163
Ulmus, alata, americana, campestris, effusa, fulva, 164, 165
Umbelliferæ, 53, 437
Umbellularia californica, 236
Umbrella plant, 210
Unguent, -um, -a, ointments, 22

Unguent, -um, -a, aconitinæ, 206
atropinæ, 539
bituminis sulphonati, 846
calaminæ, 801
cantharidini, 638
cetacei, 649
cocainæ, 338
creosoti, 891
eucalypti, 434
fuscum, 807
gallæ cum opio, 158
hydrargyri oleati, 826
oxidi rubri, 829
lanæ compositum, 657
picis compositum, 79
plumbi iodidi, 807
subacetatis, 806
potassii iodidi, 717
resorcinolis compositum, 896
sinapis, 255
stramonii, 550
sulphuris alkalinum, 691
compositum, 691
veratrinæ, 106
zinci oleatis, 798
Universe vine, 463
Upstart, 107
Ural, uralium, uraline, 924
Uranium, 795
nitrate, 795
Urari, 485
Urea derivatives, 882, 924
Urethane, 883, 924
Urginea, maritima, 107, 117
Uritone, 856
Urotropine, 856, 920
Urson, 465
Urtica dioica, 172
Ustilago Maydis, 67
Uva ursi, 463

V

Vaccinium uliginosum, Vitis-Idæa, 464
variolæ, 669
Vagnera racemosa, 121
Valerian, American-English, cat's, common, English, German, great-wild, Vermont, wild, 594
family, 594
Valeriana, celtica, dioica, mexicana, officinalis, Phu, toluccana, Wallichii, 594, 595, 597
Valerianaceæ, 54, 594
Valerianæ indicæ rhizoma, 597
Vallonea, 160
Vanilla, aromatica, Bourbon, Brazilian, Gardneri, Guadeloupe, Java, Mauritius, Mexican, odorata, phæantha, planifolia, Pompona, Seychelles, S. American, Tahiti, Vera Cruz, 139, 141, 142
Vanillinum, vanillin, vaniglia, 139, 141, 469, 470
Vanillons vanilla, 141
Vapors, vapores, 25
Varnish, pulp capping, 388
Vaseline, white, 843, 844, 845
Vegetable calomel, 210
gelatin, 55
mercury, 210
sponge, 600
sulphur (brimstone), 70
Vengaz, 320
Veratramarin, 103
Veratrina, veratrine, veratrate, veratria, 105, 106
Veratroidine, 103
Veratrum, album, false, swamp, viride, white, 102, 103, 105, 595
Verbasci flores, folia, 559, 560
Verbascum, phlomoides, thapsiforme, Thapsus, 554, 559, 560
Verbena, hastata, 508
Verdigris, 810
Verek, 283
Vermicides, vermifuges, 45
Veronal, 882, 925
sodium, 883
soluble, 883
Veronica, officinalis, virginica, 558, 559
Vertebrata, 643
Vesicants, 46
Vetivert, vetiveria, 96
Viburnum, americanum, obovatum, Opulus, prunifolium, 591, 592, 593
Vinegar, 870
opium, 246
squill, 119
Vinegars, 19
Vinum, antimonii, 836
ferri, 776, 784
rhei compositum, 183
Viola, pedata, tricolor, 415
Virgin dip, 75
Virus vaccinicum, 669
Vitis vinifera, 396
Viverra Civetta, Zibetha, 662
Vomit nut, 479
wort, 606
Vouacapoua Araroba, 323

W

Wafer-ash, 352
Wafers, 24
Wahoo, 165
Wars, Warrus, 326
Wash-rag sponge, 600
Water, 677
allspice, 430
ammonia, 680
stronger, 682
anise, 445
avens, 271
bitter almond, 277
camphor, 230
caraway, 430

Water, chlorine, 698, 714
chloroform, 861
cinnamon, 226
distilled, 677
sterilized, 678
eucalyptus, 430
fennel, 448
lead, 806
lime, 757
mineral, 678
orange flowers, 355
peppermint, 527
rose, 265
stronger, 265
shamrock, 491
spearmint, 523
Waters, aëration, 19
aromatic, 19
distillation of, 19
solution of, 19
Waterleaf family, 506
Watermelon seed, 605
Weed, stinking, 185
Weights and measures, 984, 985
Wheat, Guinea, Turkey, 87
Whey, 672
Whisky, raw, 849
White mallow, 397
precipitate, 823
tree, 428
vitriol, 798
wax, 642
wood, 428
Whortleberry, bog, red, 463, 464
Wild China tree, 390
lemon, 210
mandrake, 210
oat, 96
potato, 506
Willow, common, crack, duck, European, Huntington, purple, salicin, white, 152, 153
family, 152
Wine, bitter,orange, 355
coca, 338
colchicum corm, strong, 111
ipecac, 589
port, 851
quinine, 575
red, 397, 851
sherry, 851
white, 397, 851
Wineberry, 464
Wines, vina, 25
Wing-seed, 352
Winter-berry, 391
Winter lien, 331
Wintera, aromatica, 190
Wintergreen, aromatic, creeping, greenish-flowered, round-leaved, spicy, spotted, spring, 460, 463
Witch hazel family, 257
leaves, 260
Withe, withy, 152
Witherite, 768
Wolfroot, 204
Wolfsbane, 204
Wolf's claw, 70
Wood, anemone, 208
charcoal, 684
flower, 208
naphtha, 919
Wool fat, 655, 656
hydrous, 657
Woolly butt, 431
Woorara, 485
Worm grass, 487
Wormseed, Aleppo, Alexandria, American, Barbary, European, Indian, Levant, wild, 185, 609, 610, 611
Wormwood, 611
Wymote, 397

X

Xanthium, canadense, echinatum, spinosum, Strumarium, 549, 623
Xanthorrhiza, apiifolia, 200
Xanthoxyli fructus, 344
Xanthoxylum, elegans, 349
Xeroform, 930
X-rays, 950

Y

Yarrow, 624
Yellow adder's-tongue, 117
cinchona, 561
daisy, 622
dip, 75
eye, 194
gentian root, 488
jasmine (root), 485
parilla, 221
puccoon, 194
wash (lotion), 823
wax, 640, 641, 642
Yerba santa, 507

Z

Zanthoxylum, americanum, caribæum, Clava-Herculis, floridanum, pterota, 343, 344, 345
Zea Mays, Maize, 67, 87, 89, 91
Zedoaria, zedoary, 134
Zibethum, 662
Zinc, Zincum, 796
acetate, 800
bromide, 802
carbonate, precipitated, 802
chloride, 796
iodide, 802
oxide, 799
phenolsulphonate 801
phosphide, 803
stearate, 800
sulphate, 798
valerate, 802
Zinc-white, (flores), 799
Zingiber, Cassumunar, Mioga, officinale, Zerumbet, 129, 132
Zingiberaceæ, 50 129
Zymine, 651

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